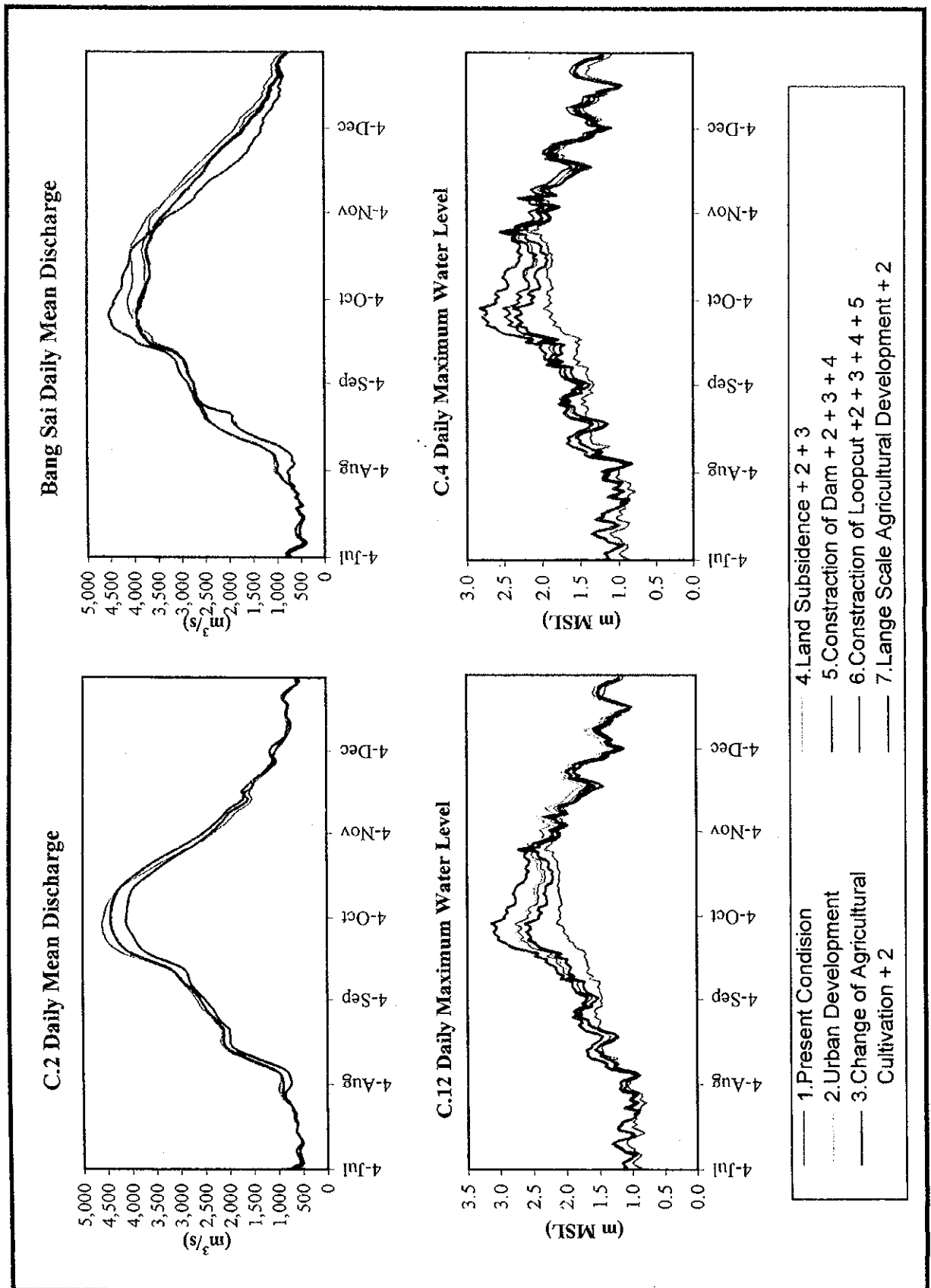


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

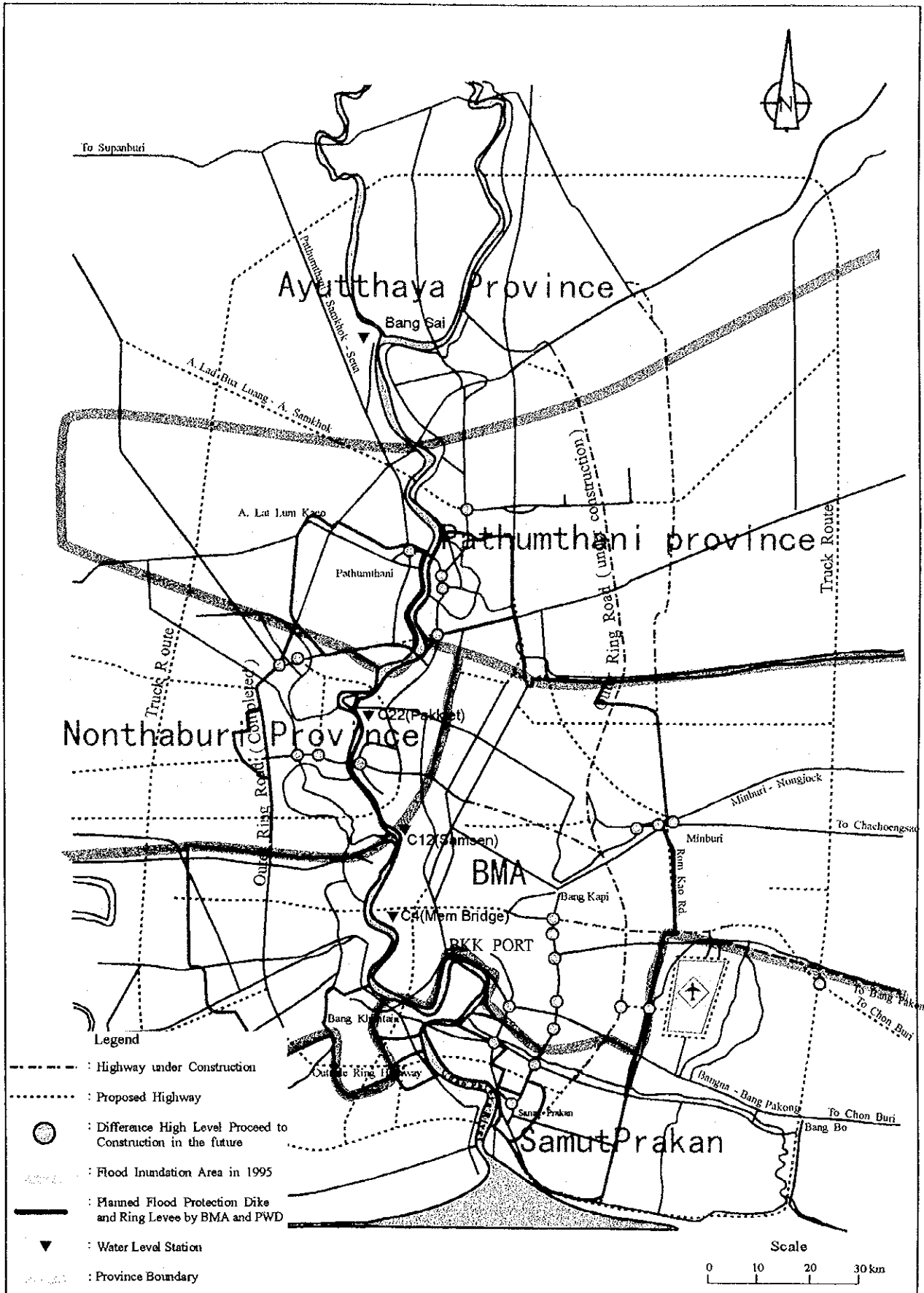
Fig. 4.1.4
LARGE SCALE DEVELOPMENT AREA

CTI ENGINEERING CO., LTD AND INA CORPORATION



STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD. AND INA CORPORATION

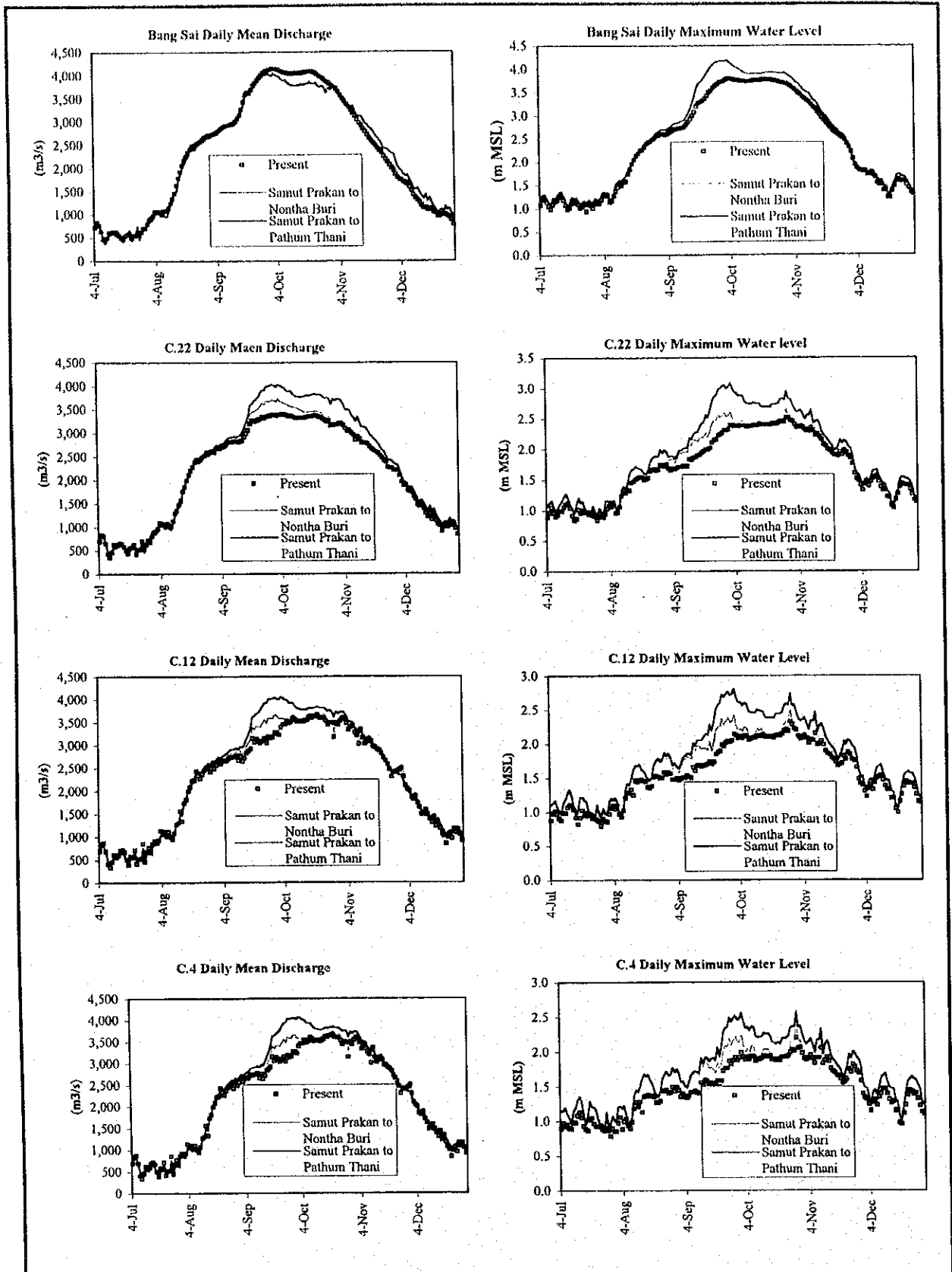
Fig. 4.1.5
INFLUENCE OF FUTURE DEVELOPMENT



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

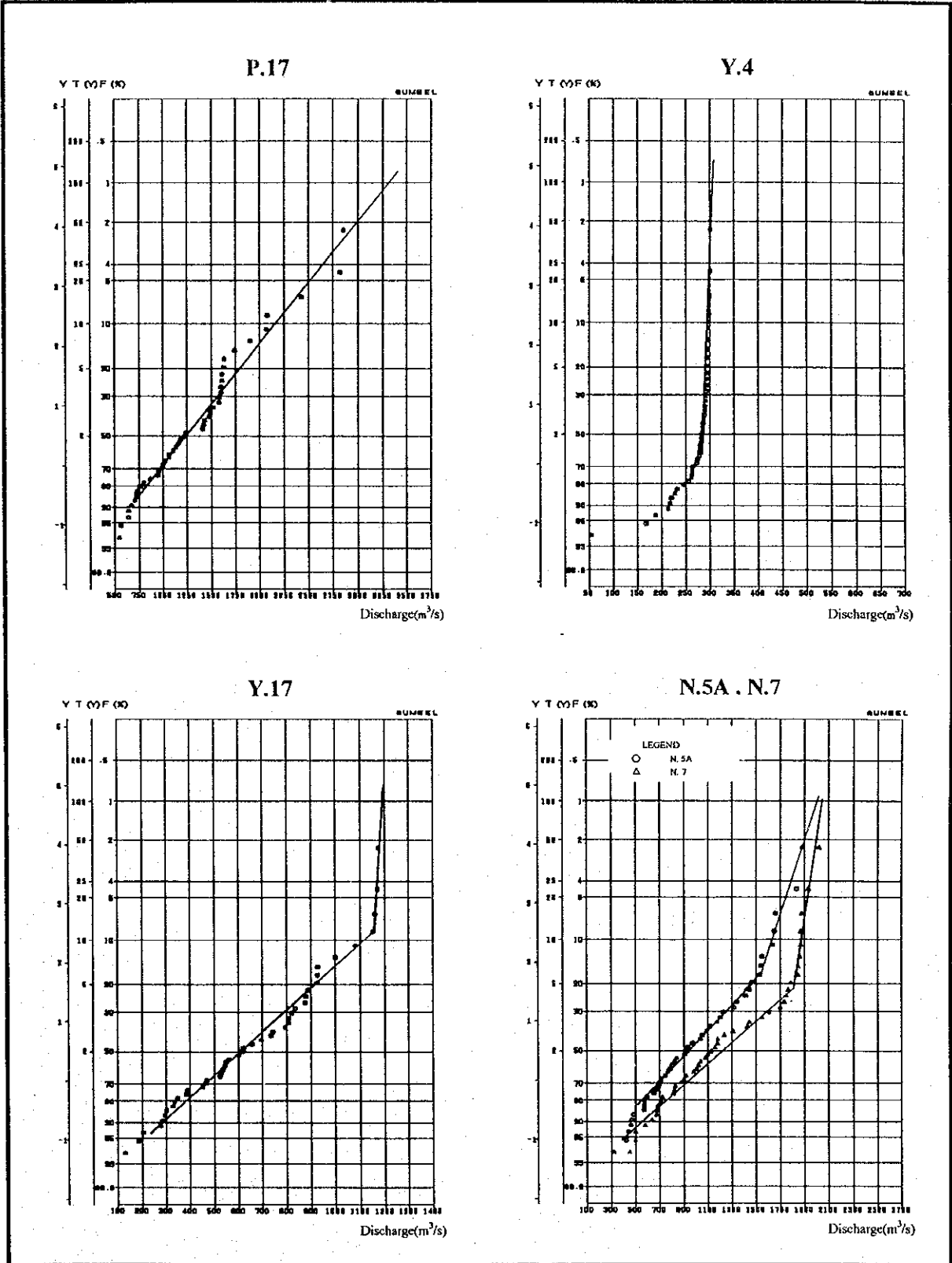
CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.1.6
FLOOD INUNDATION AREA IN 1995 AND
PLANNED FLOOD PROTECTION DIKE
ON LOWER CHAO PHRAYA RIVER



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

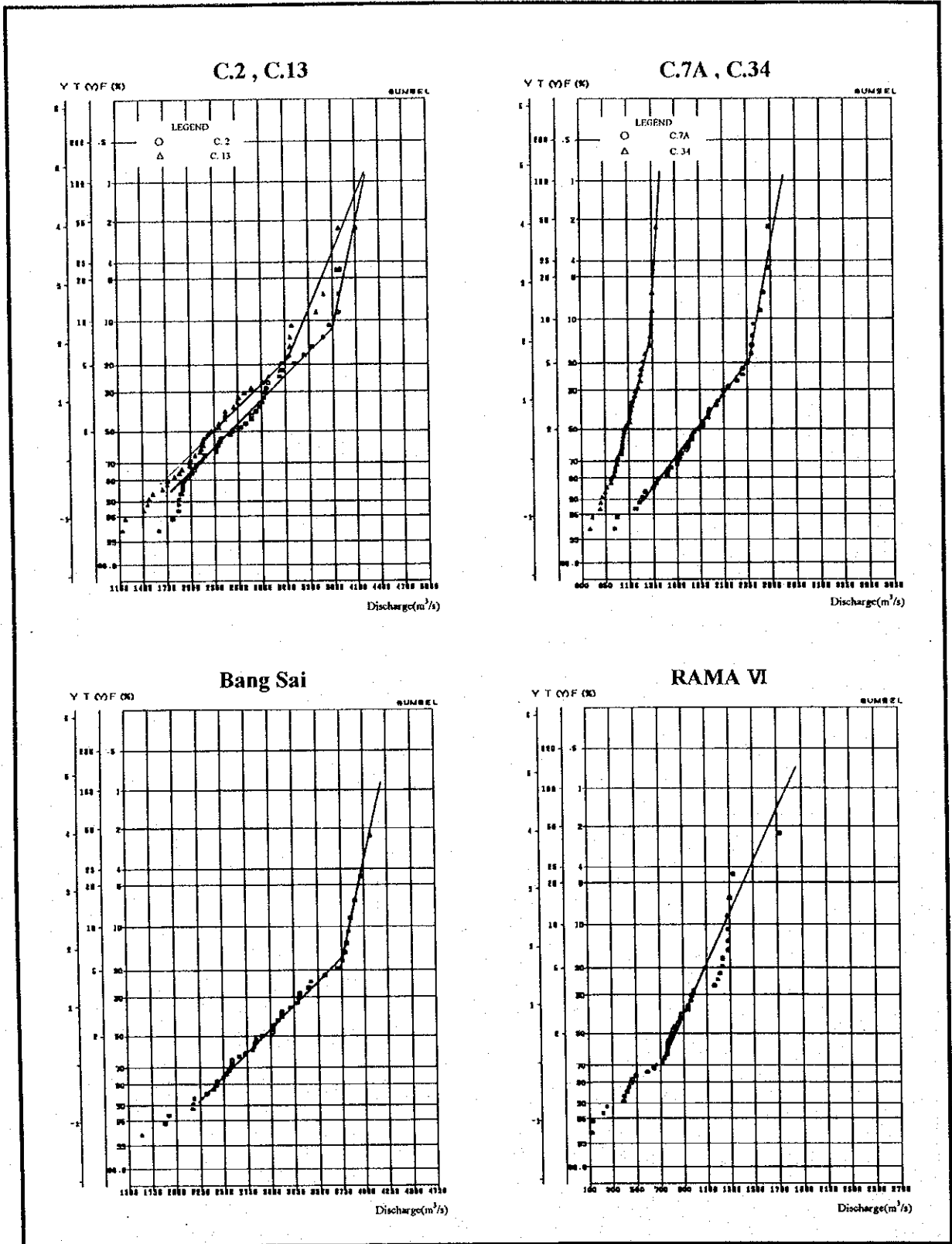
Fig. 4.1.7
INFULUENCE OF URBAN RING LEVEE



STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.1.8 (1/2)

PROBABLE DISCHARGE
 IN FUTURE BASIN CONDITION

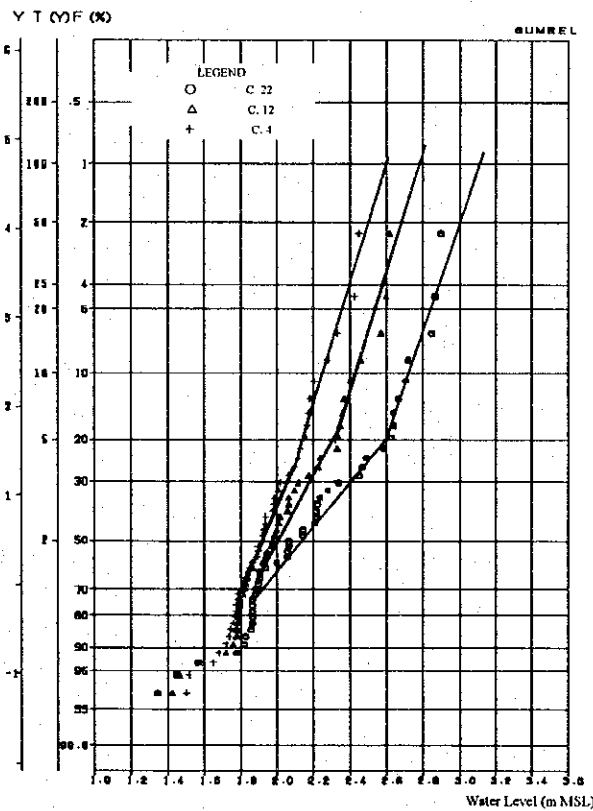


STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.1.8 (2/2)
 PROBABLE DISCHARGE
 IN FUTURE BASIN CONDITION

River	Station	Probable Maximum Water Level by Return Period(m MSL)					
		2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Chao Phraya	C.22(Pak Kret)	2.15	2.61	2.72	2.86	2.96	3.07
	C.12(Samsen)	2.00	2.34	2.45	2.60	2.70	2.80
	C.4(Mem.Bridge)	1.92	2.16	2.25	2.39	2.48	2.57

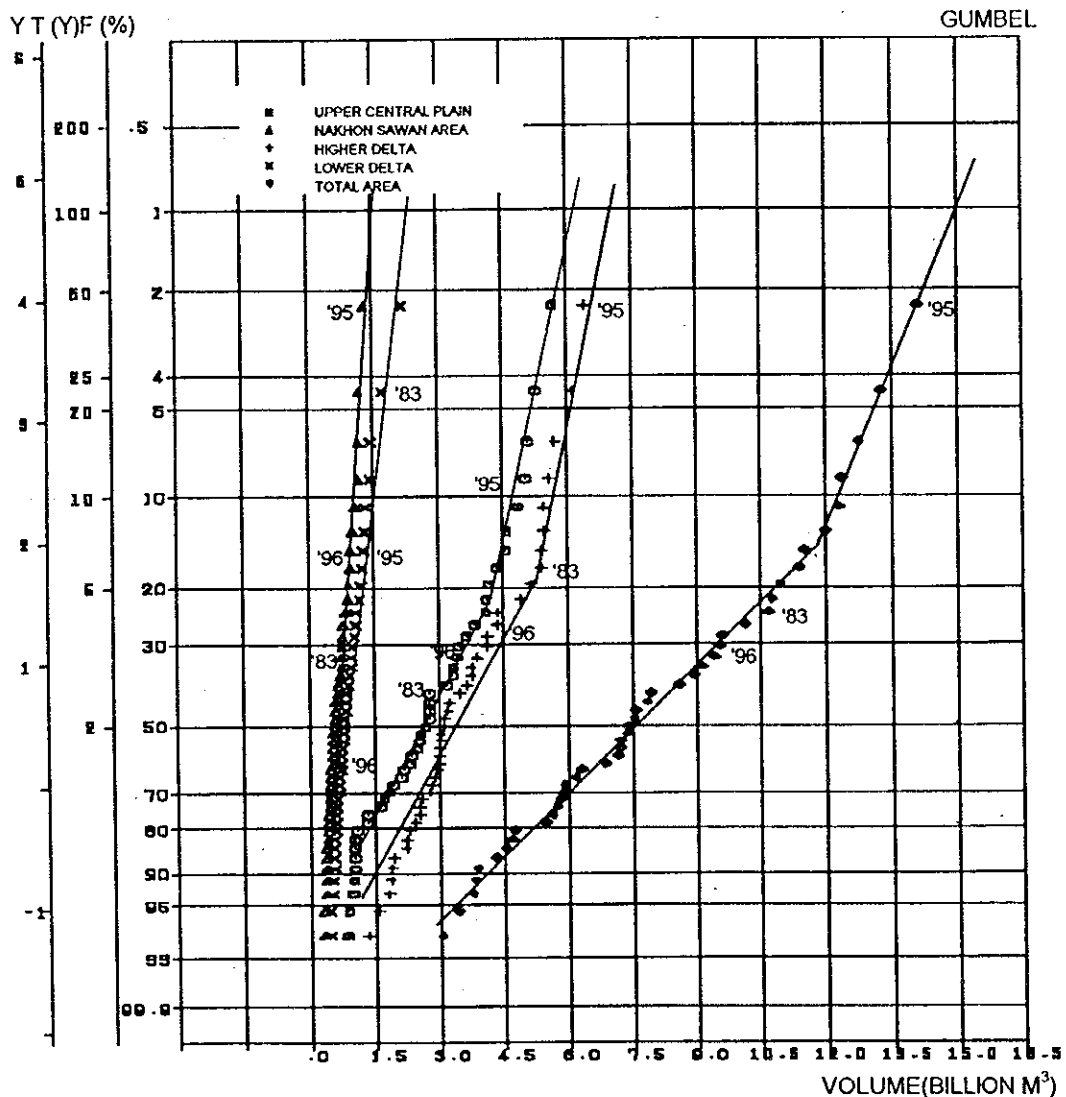
C.22 , C.12 , C.4



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO. , LTD & INA CORPORATION

Fig. 4.1.9
PROBABLE WATER LEVEL
IN FUTURE BASIN CONDITION

Station	Probable Inundation Volume by Return Period (billion m ³)					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Upper Central Plain	2.5	4.1	4.7	5.3	5.9	6.3
Nakhon Sawan Area	0.6	1.0	1.2	1.3	1.4	1.5
Higher Delta	3.3	5.1	5.6	6.1	6.6	6.9
Lower Delta	0.7	1.2	1.6	1.9	2.1	2.3
Total Area	7.6	11.0	12.4	13.3	14.2	15.0



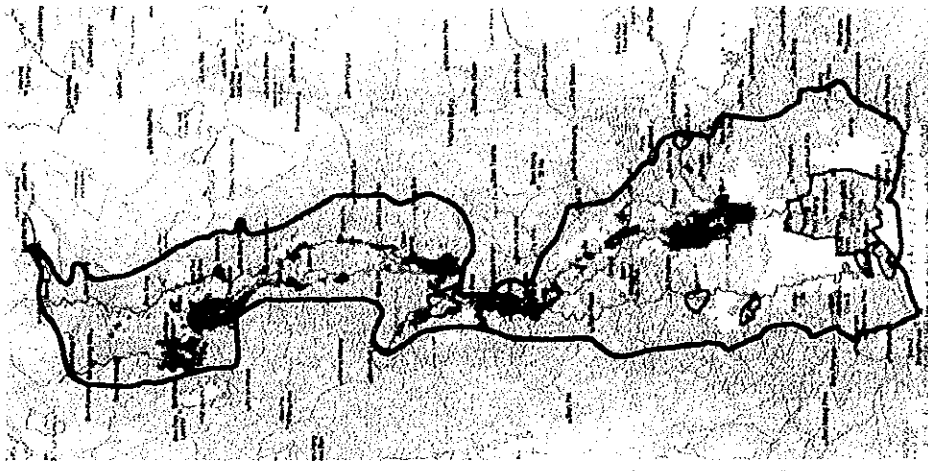
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD & INA CORPORATION

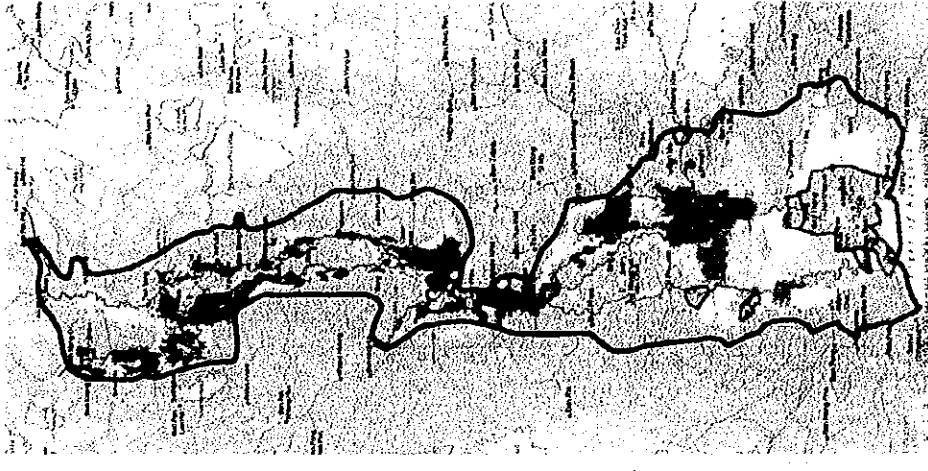
Fig. 4.1.10

PROBABLE INUNDATION VOLUME IN FUTURE BASIN CONDITION

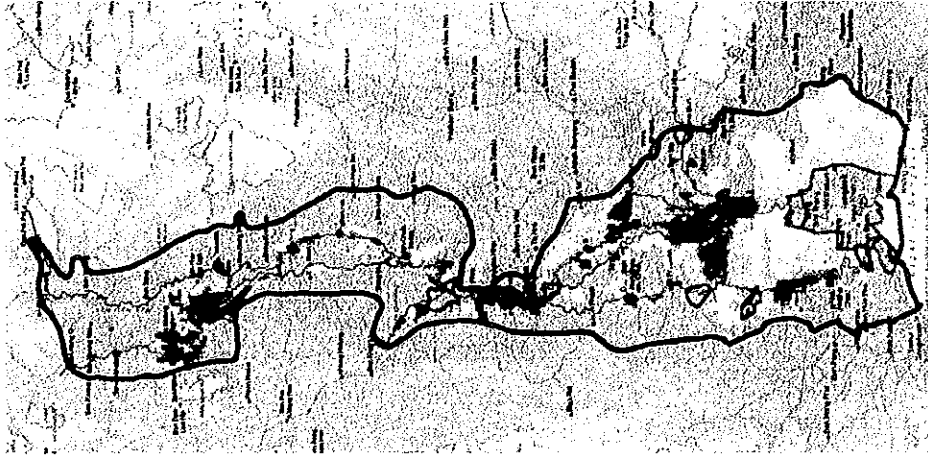
1996



1995



1983



Boundary of Probable
Maximum Flood Area

Ring Dike

Main River

Water Depth (m)

0.2 - 0.5

0.5 - 1

1 - 1.5

1.5 - 2

2 - 2.5

2.5 - 3

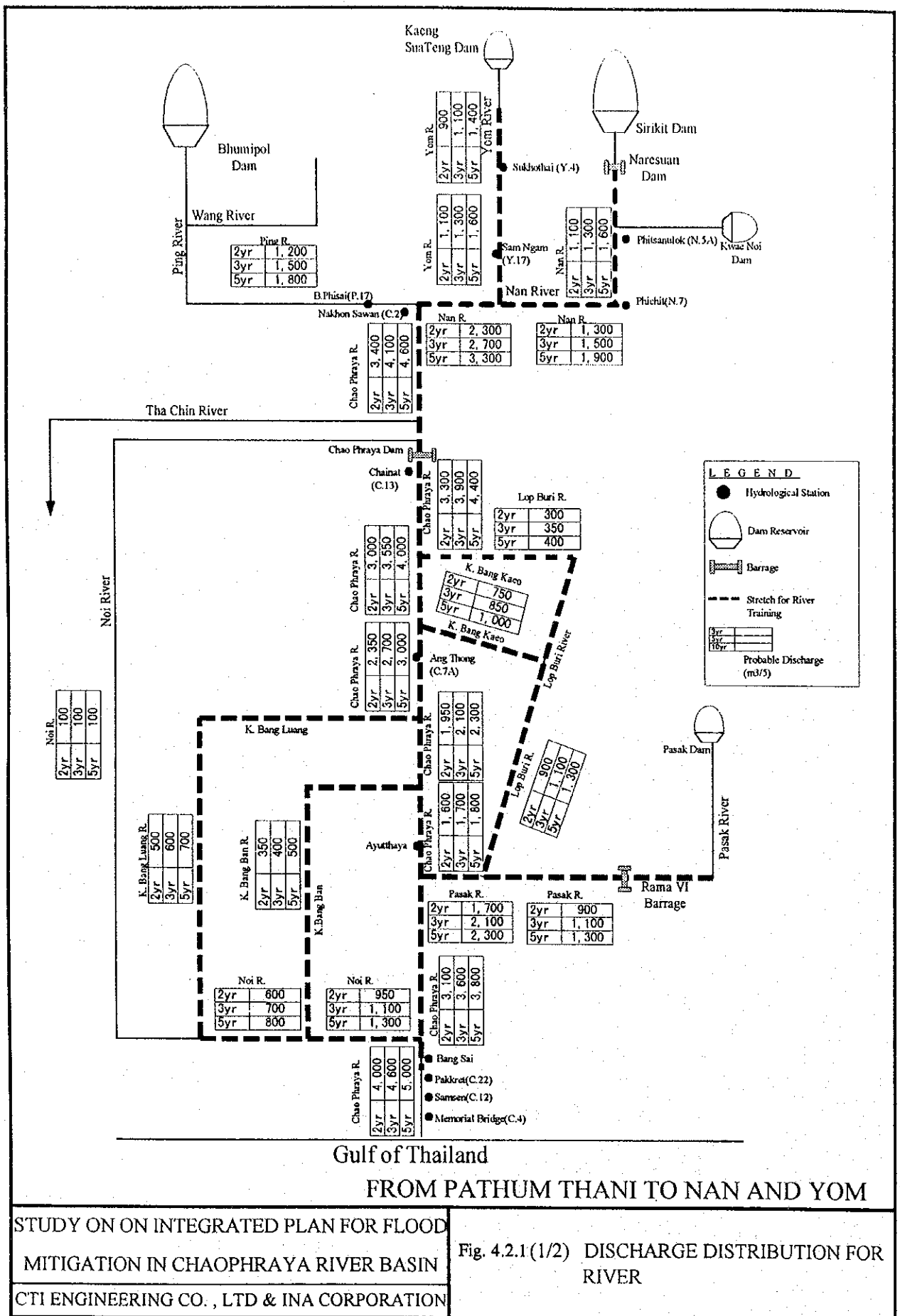
3 - 3.5

>3.5

0 50 100km
Scale

STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD. AND INA CORPORATION

Fig. 4.1.11
FLOOD MAP IN FUTURE BASIN
CONDITION



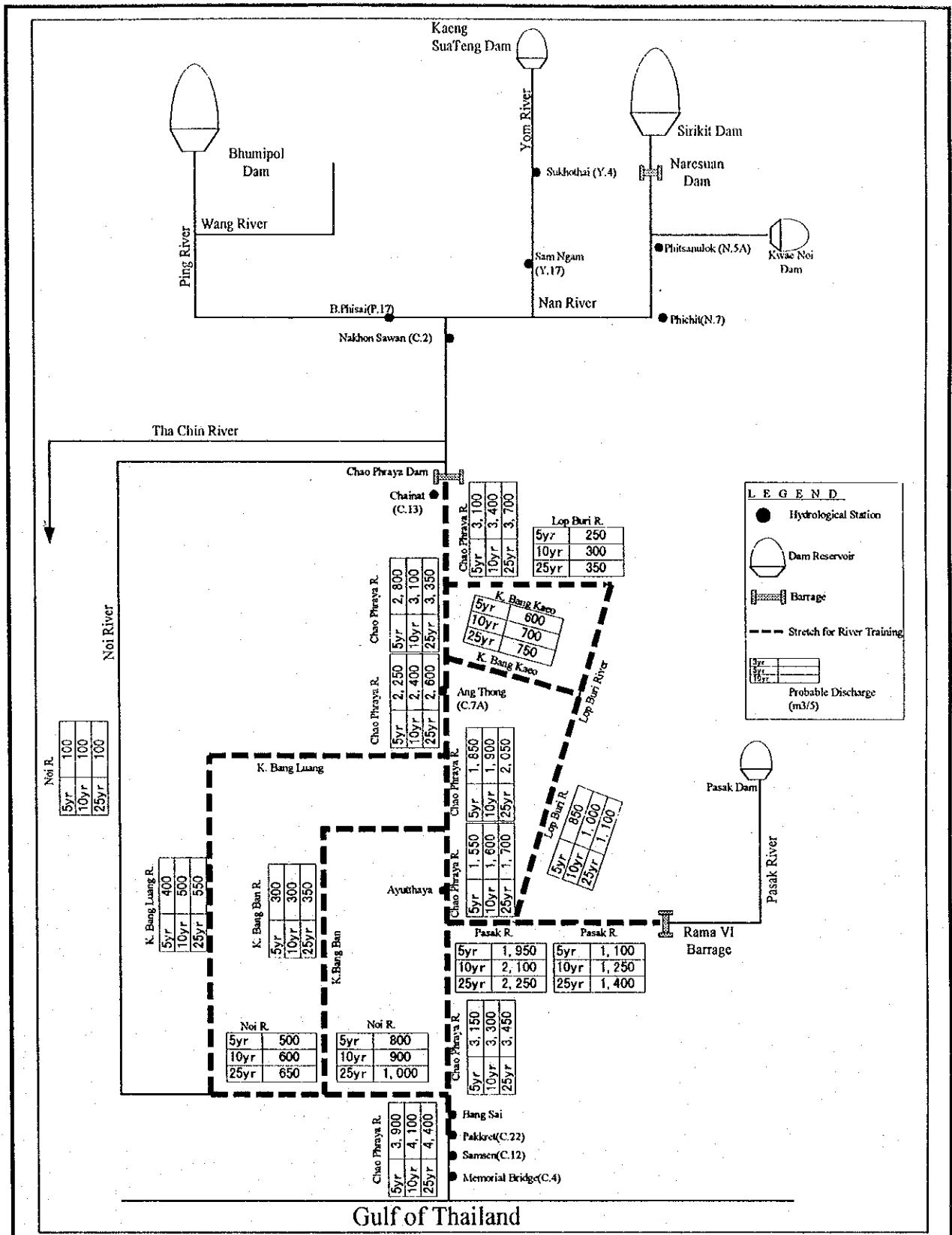
LEGEND

- Hydrological Station
- ◐ Dam Reservoir
- ▬ Barrage
- - - Stretch for River Training
- | | |
|-----|--|
| 2yr | |
| 3yr | |
| 5yr | |

 Probable Discharge (m³/s)

STUDY ON ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

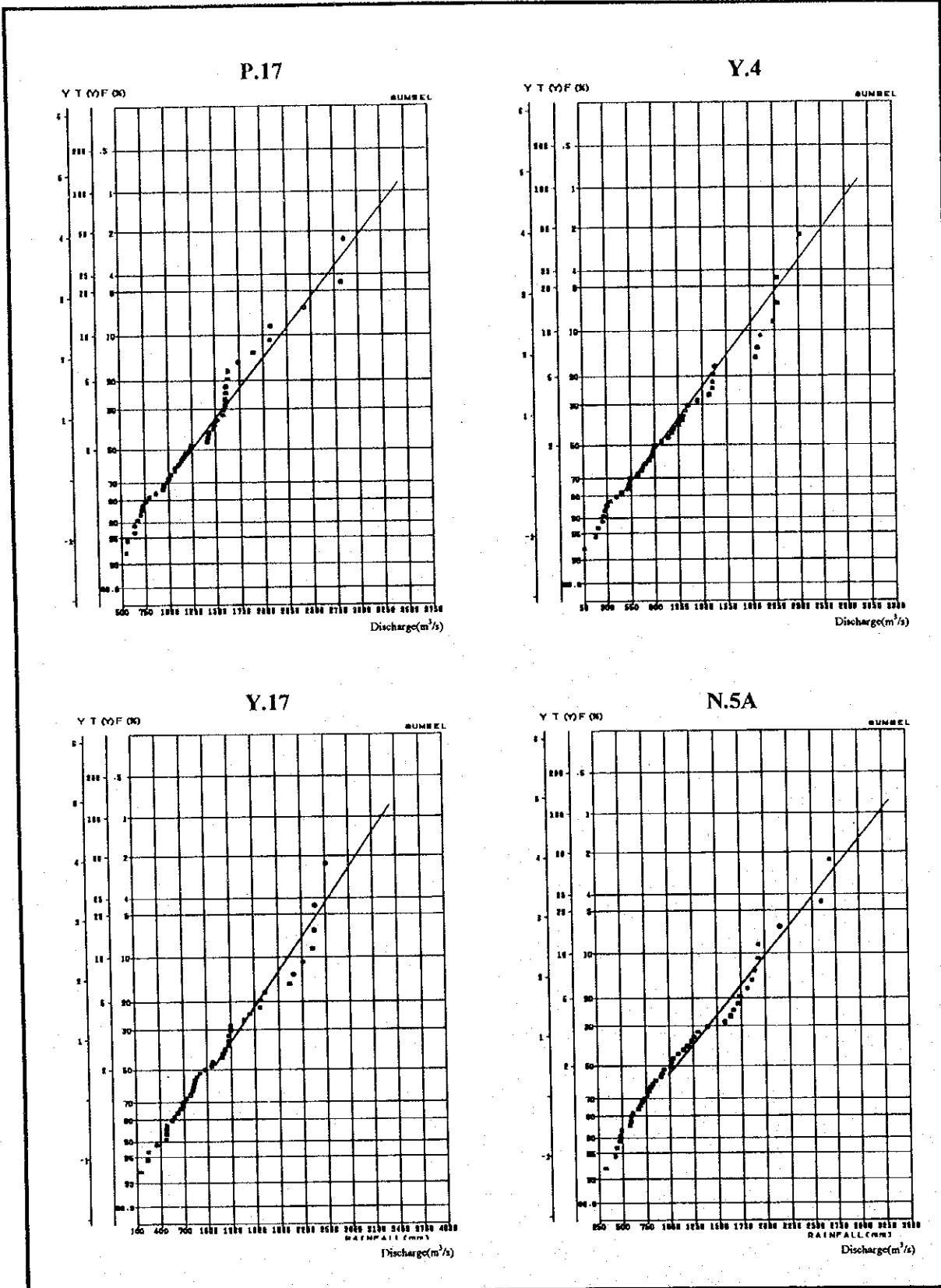
Fig. 4.2.1 (1/2) DISCHARGE DISTRIBUTION FOR RIVER



FROM PATHUM THANI TO CHAINAT

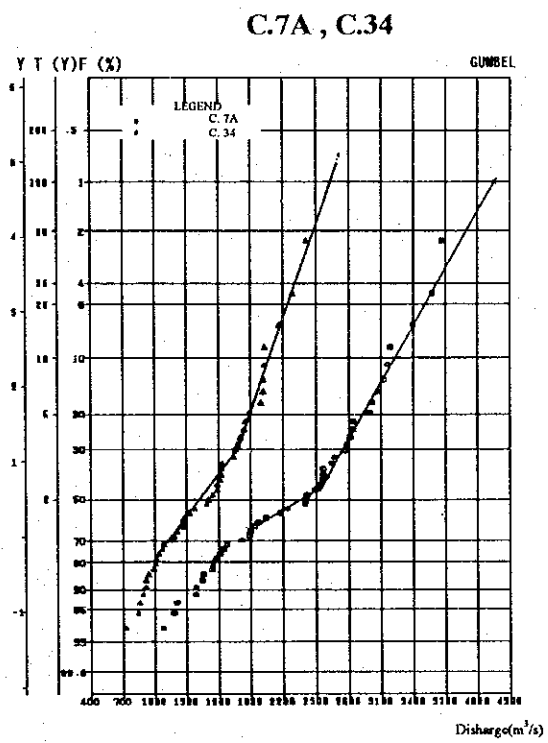
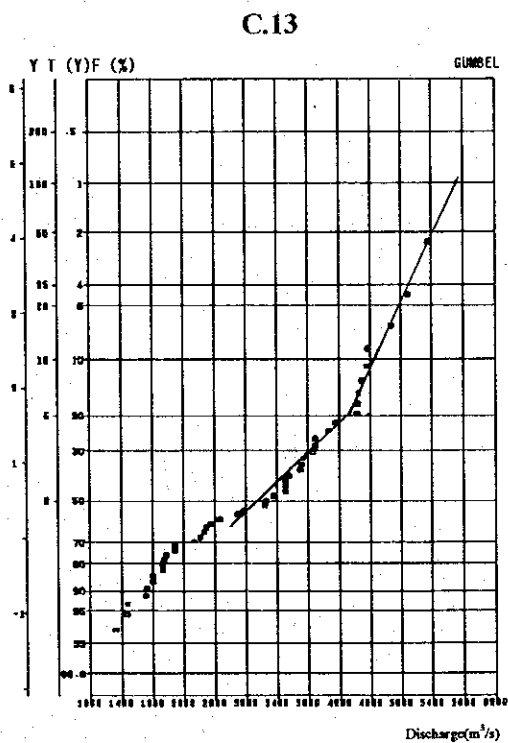
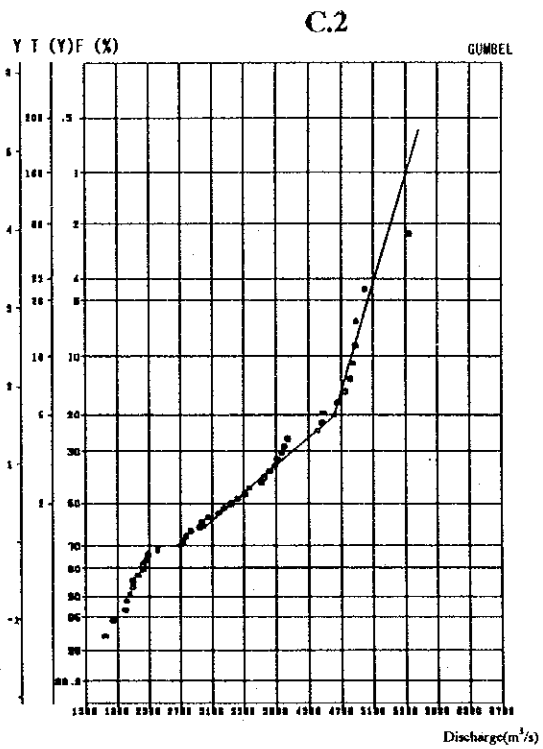
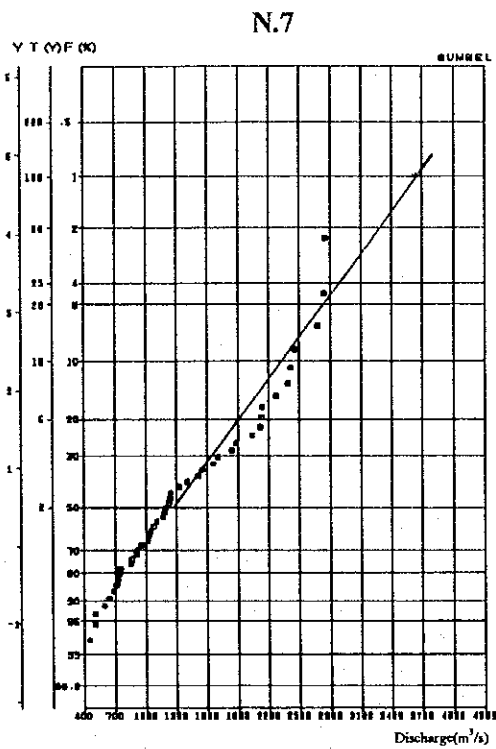
STUDY ON ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.2.1(2/2) DISCHARGE DISTRIBUTION FOR RIVER



STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

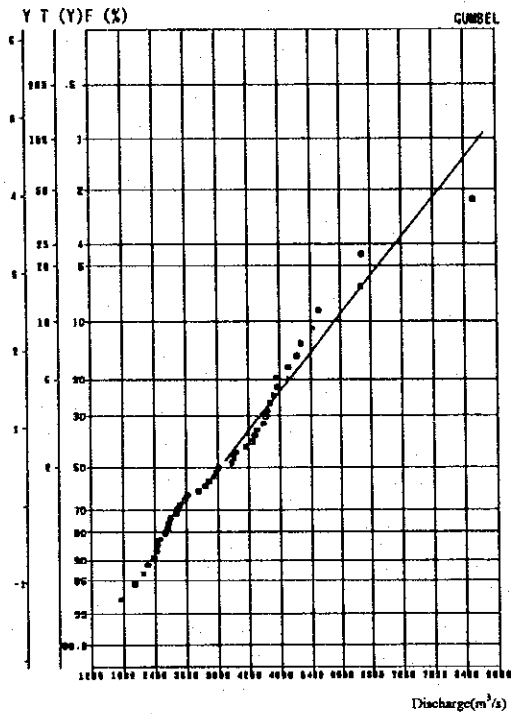
Fig. 4.2.2 (1/3) PROBABLE DISCHARGE
 UNDER FULL CONFINEMENT
 IN RIVER



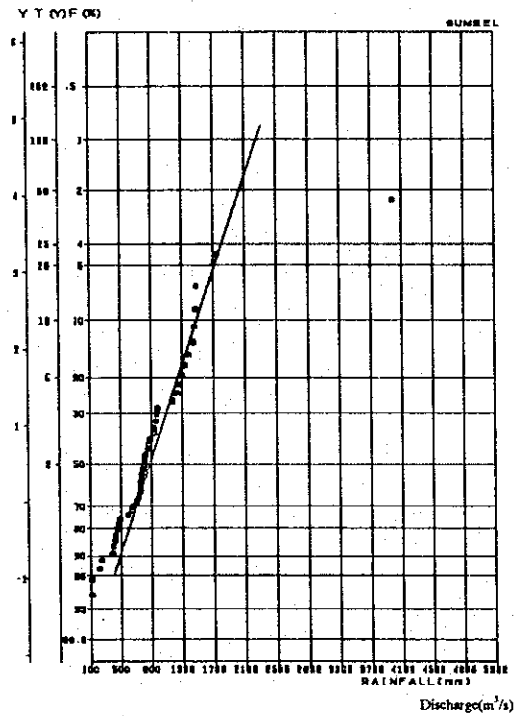
STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO. , LTD & INA CORPORATION

Fig. 4.2.2 (2/3) PROBABLE DISCHARGE
UNDER FULL CONFINEMENT
IN RIVER

Bang Sai



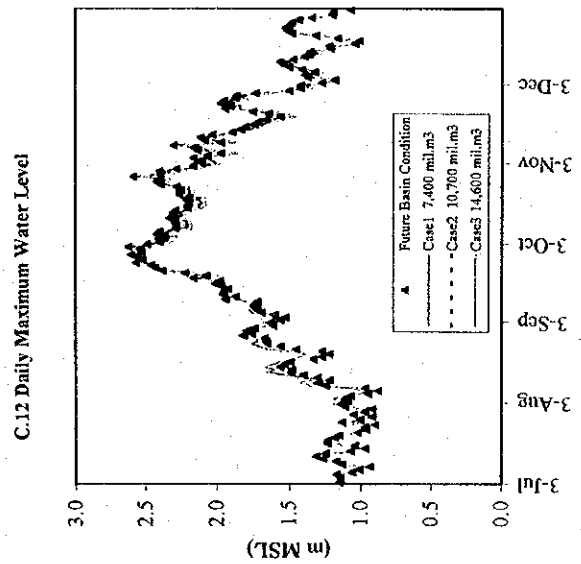
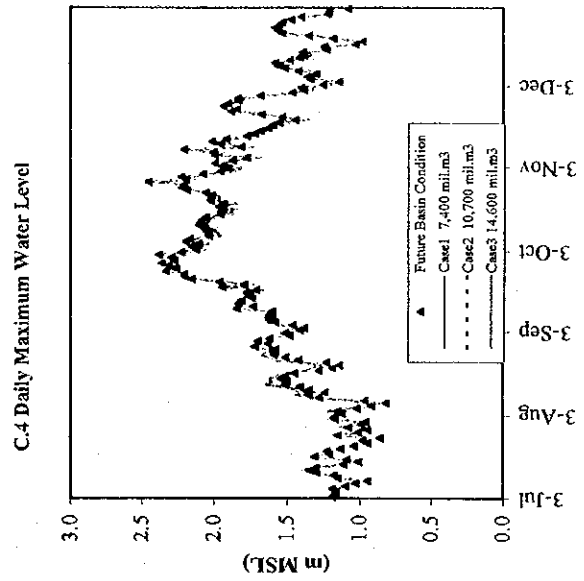
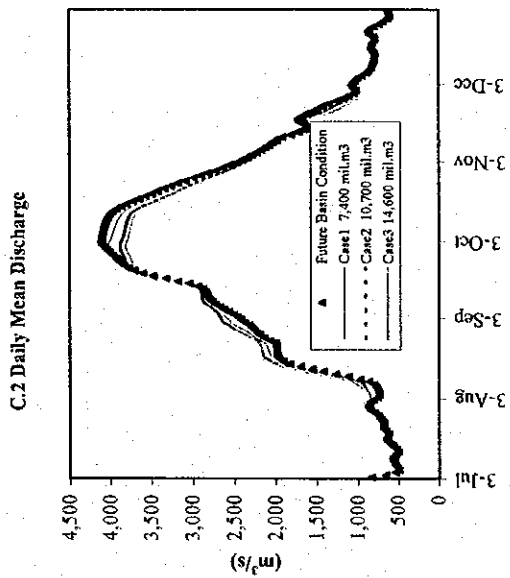
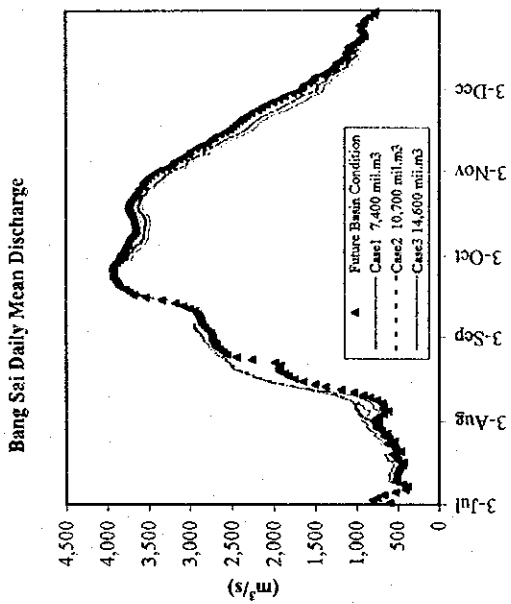
Rama .



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO. , LTD & INA CORPORATION

Fig. 4.2.2 (3/3) PROBABLE DISCHARGE
UNDER FULL CONFINEMENT
IN RIVER

Modification of Dam Operation Rule



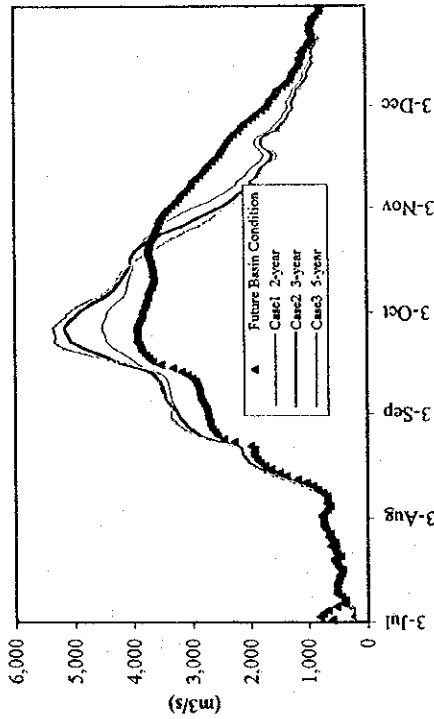
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD. AND INA CORPORATION

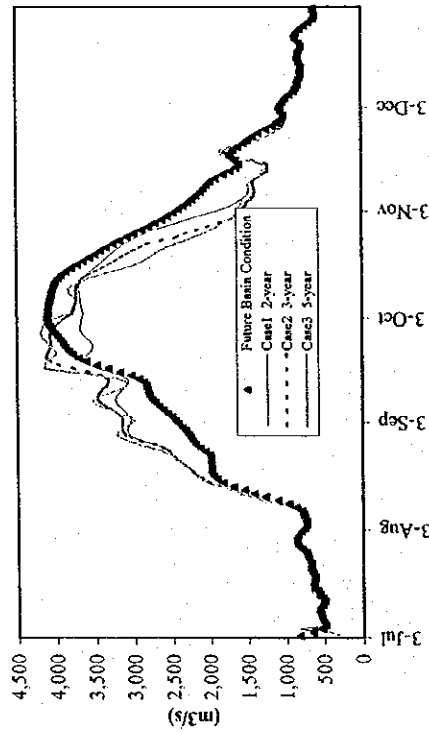
Fig.4.2.3 (1/6) EFFECTIVENESS OF PROPOSED MEASURES FOR 1995 FLOOD

River Improvement from Nan and Yom to Pathum Thani

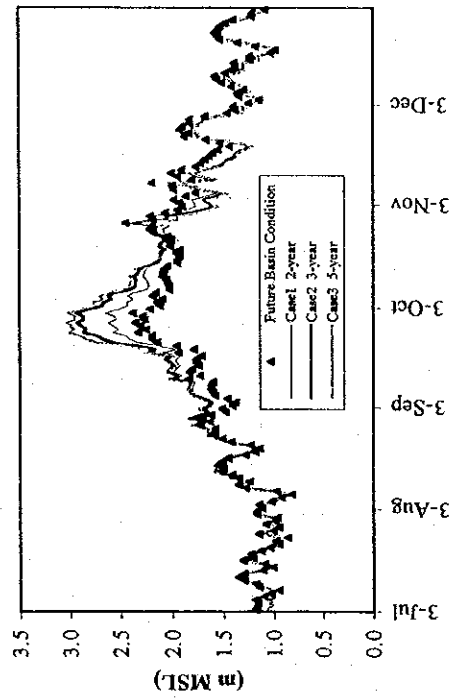
Bang Sai Daily Mean Discharge



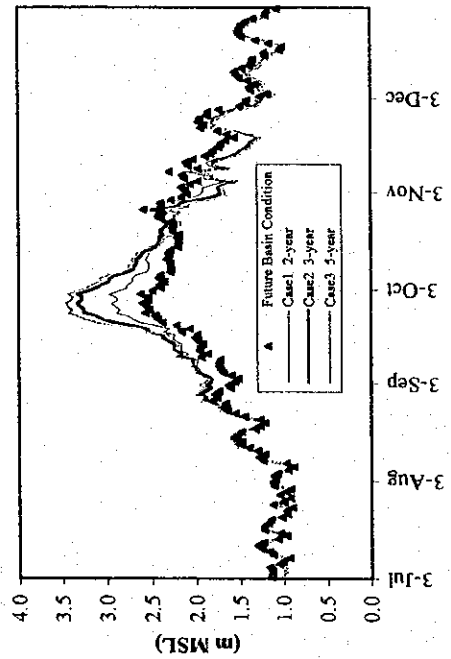
C.2 Daily Mean Discharge



C.4 Daily Maximum Water Level



C.12 Daily Maximum Water Level

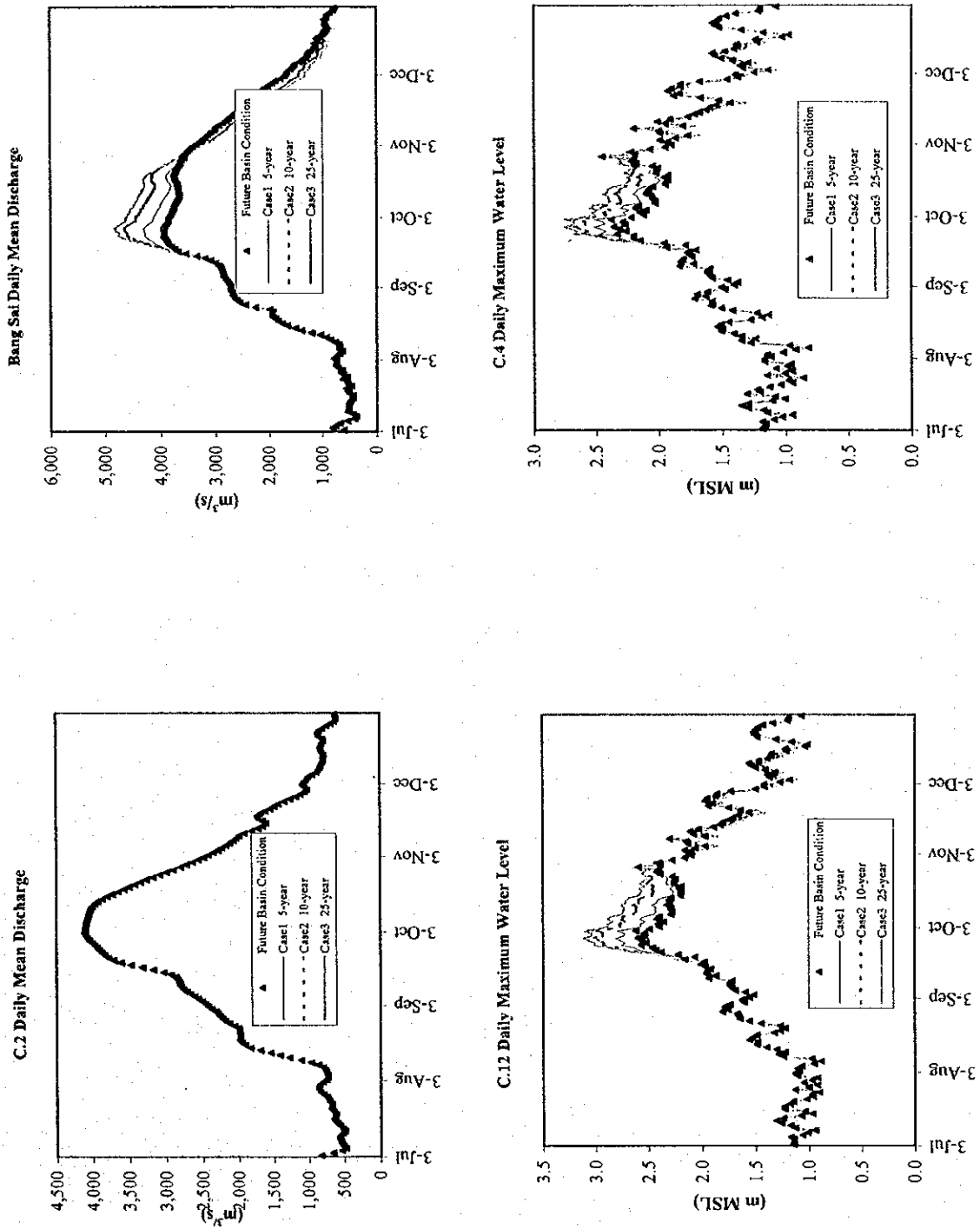


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD. AND INA CORPORATION

Fig.4.2.3 (2/6) EFFECTIVENESS OF PROPOSED MEASURES FOR 1995 FLOOD

River Improvement from Chainat to Pathum Thani

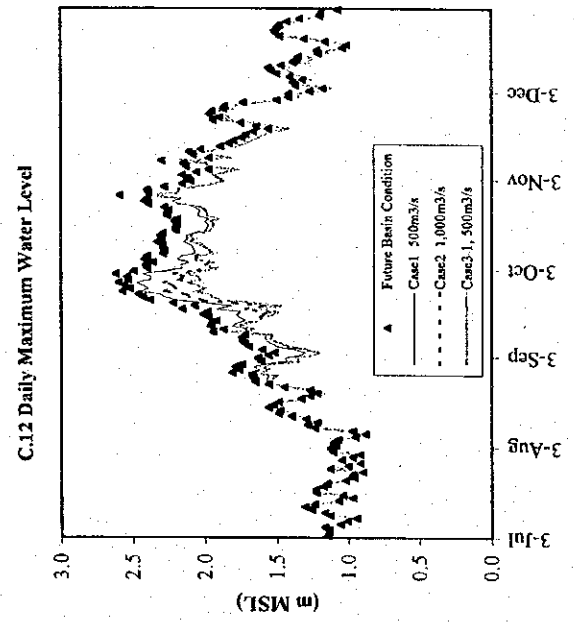
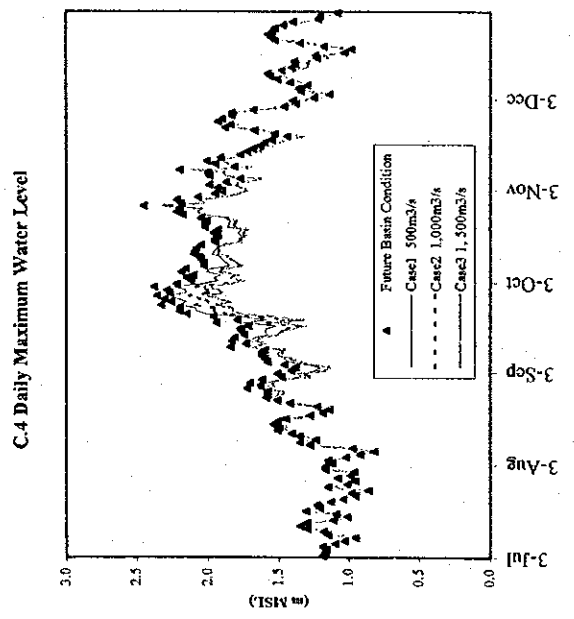
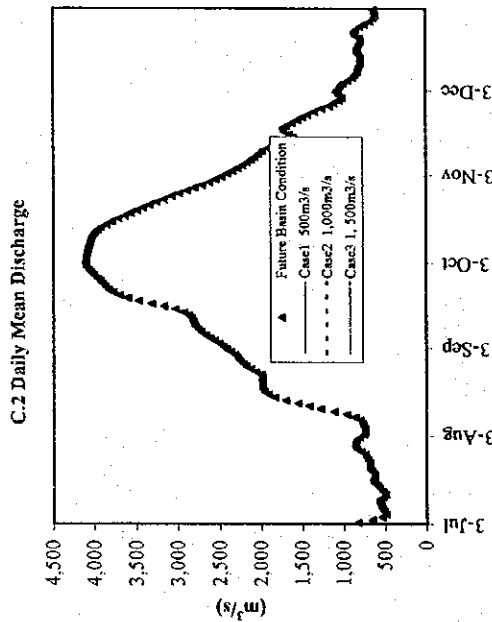
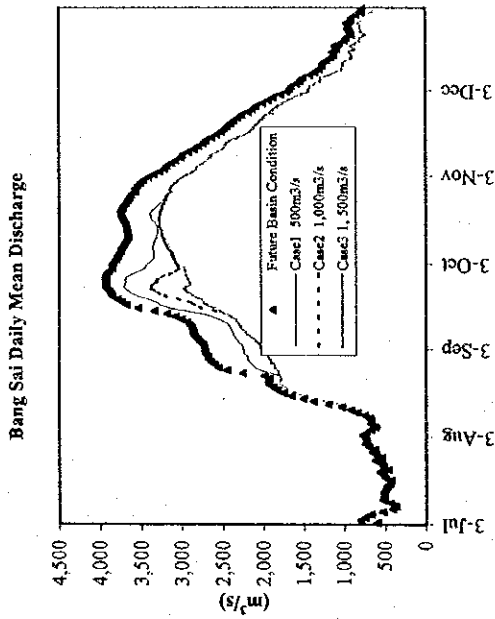


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD. AND INA CORPORATION

Fig.4.2.3 (3/6) EFFECTIVENESS OF PROPOSED MEASURES FOR 1995 FLOOD

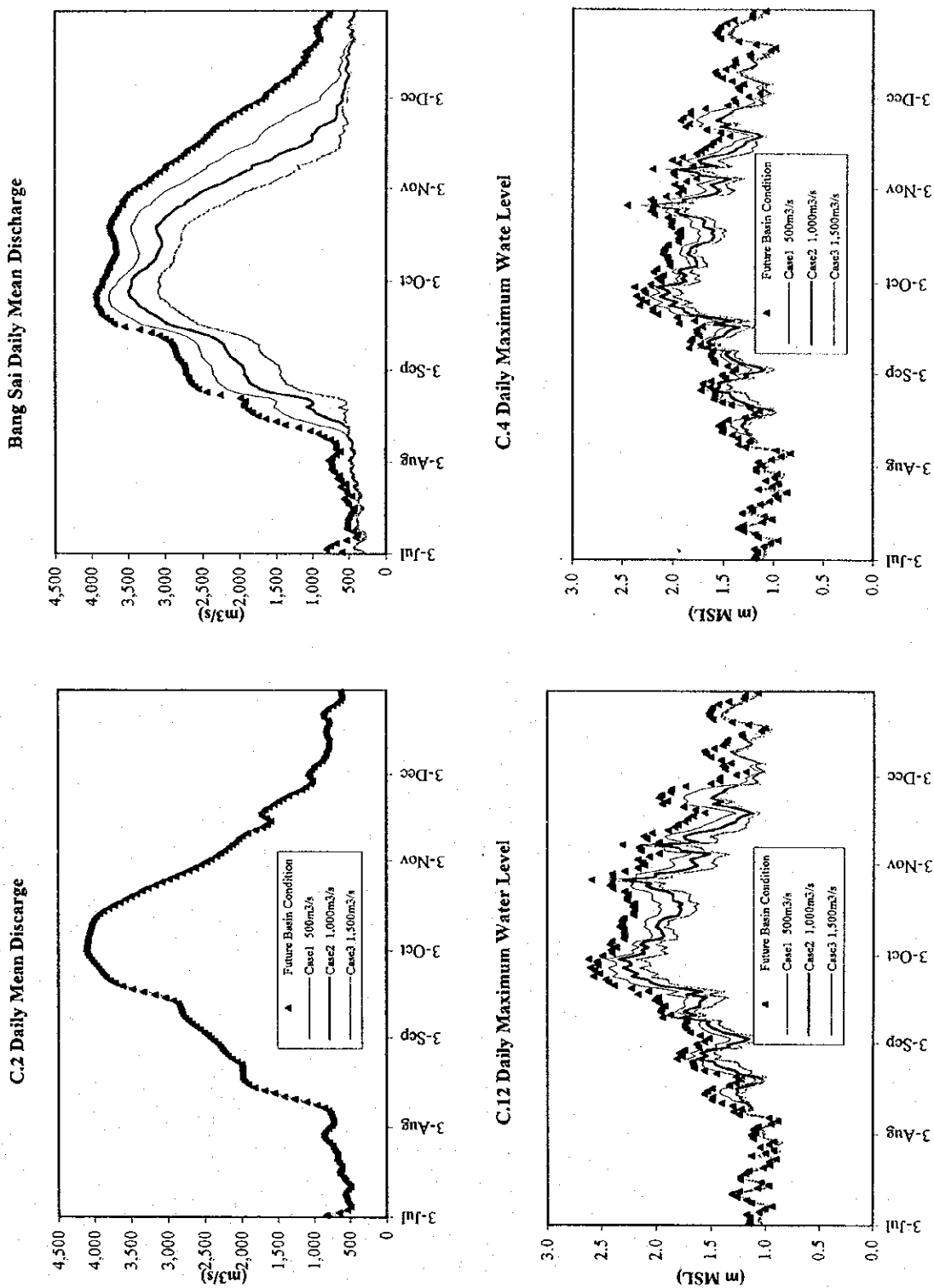
Pasak-Raphipat-Sea Diversion



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTEI ENGINEERING CO., LTD. AND INA CORPORATION

Fig.4.2.3 (4/6) EFFECTIVENESS OF PROPOSED MEASURES FOR 1995 FLOOD

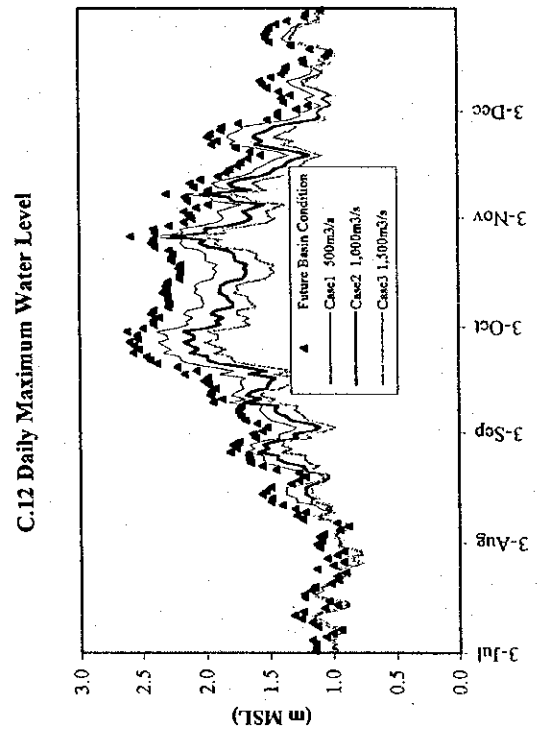
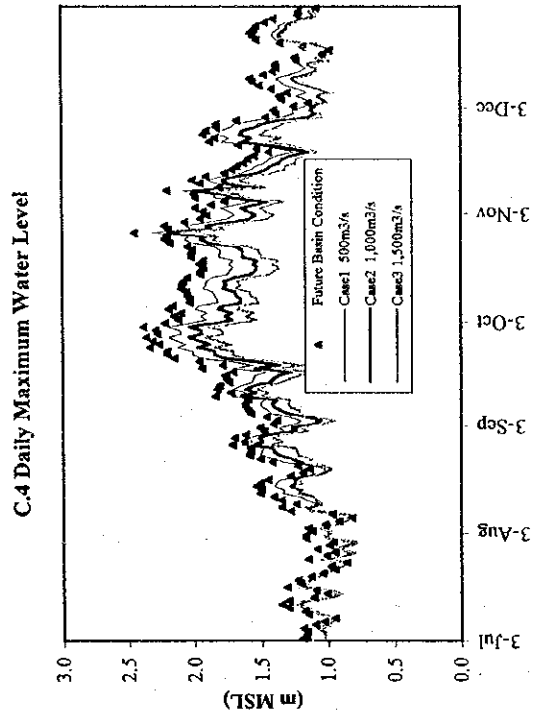
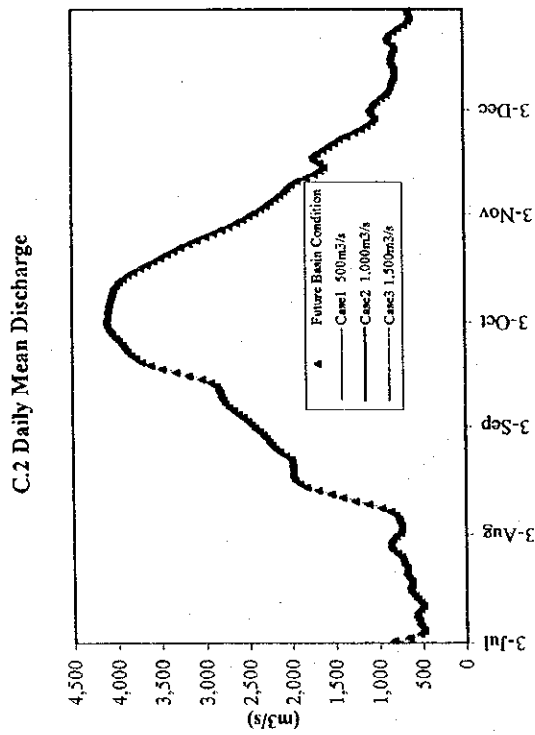
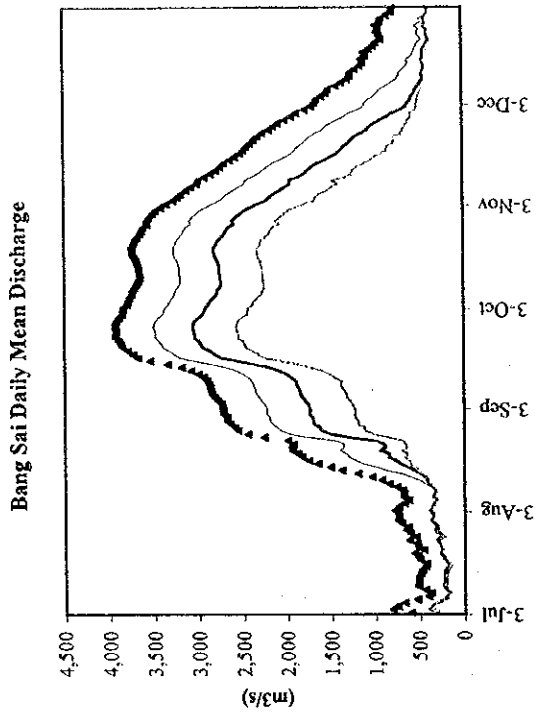
Chainat-Pasak-Raphiat-Sea Diversion



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD. AND INA CORPORATION

Fig.4.2.3 (5/6) EFFECTIVENESS OF PROPOSED MEASURES FOR 1995 FLOOD

Ayuthaya-East-Sea Diversion



STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN

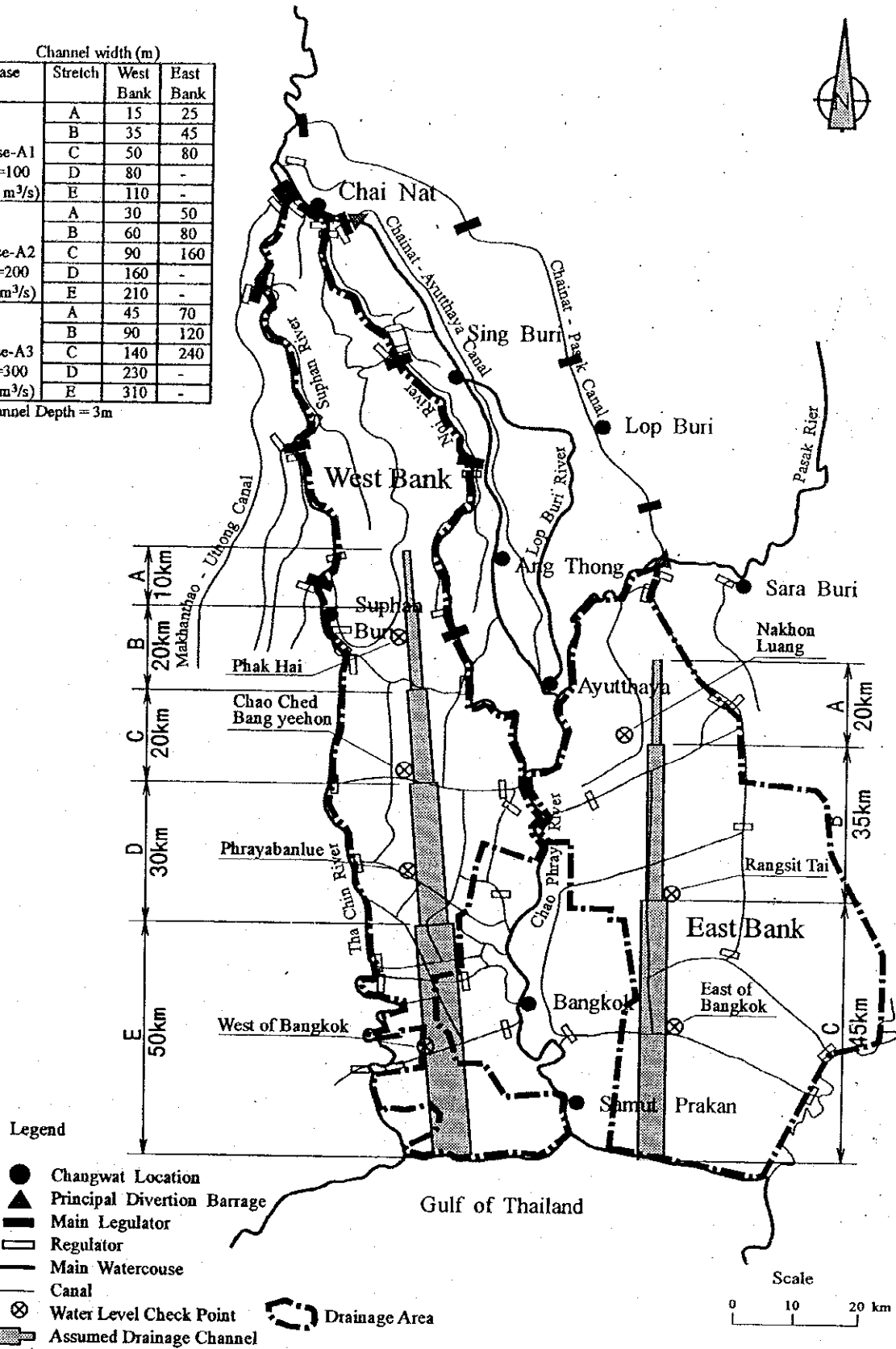
CTI ENGINEERING CO., LTD. AND INA CORPORATION

Fig.4.2.3 (6/6) EFFECTIVENESS OF
PROPOSED MEASURES
FOR 1995 FLOOD

CASE A

Case	Stretch	Channel width (m)	
		West Bank	East Bank
Case-A1 (Q=100 m ³ /s)	A	15	25
	B	35	45
	C	50	80
	D	80	-
	E	110	-
Case-A2 (Q=200 m ³ /s)	A	30	50
	B	60	80
	C	90	160
	D	160	-
	E	210	-
Case-A3 (Q=300 m ³ /s)	A	45	70
	B	90	120
	C	140	240
	D	230	-
	E	310	-

Channel Depth = 3m



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

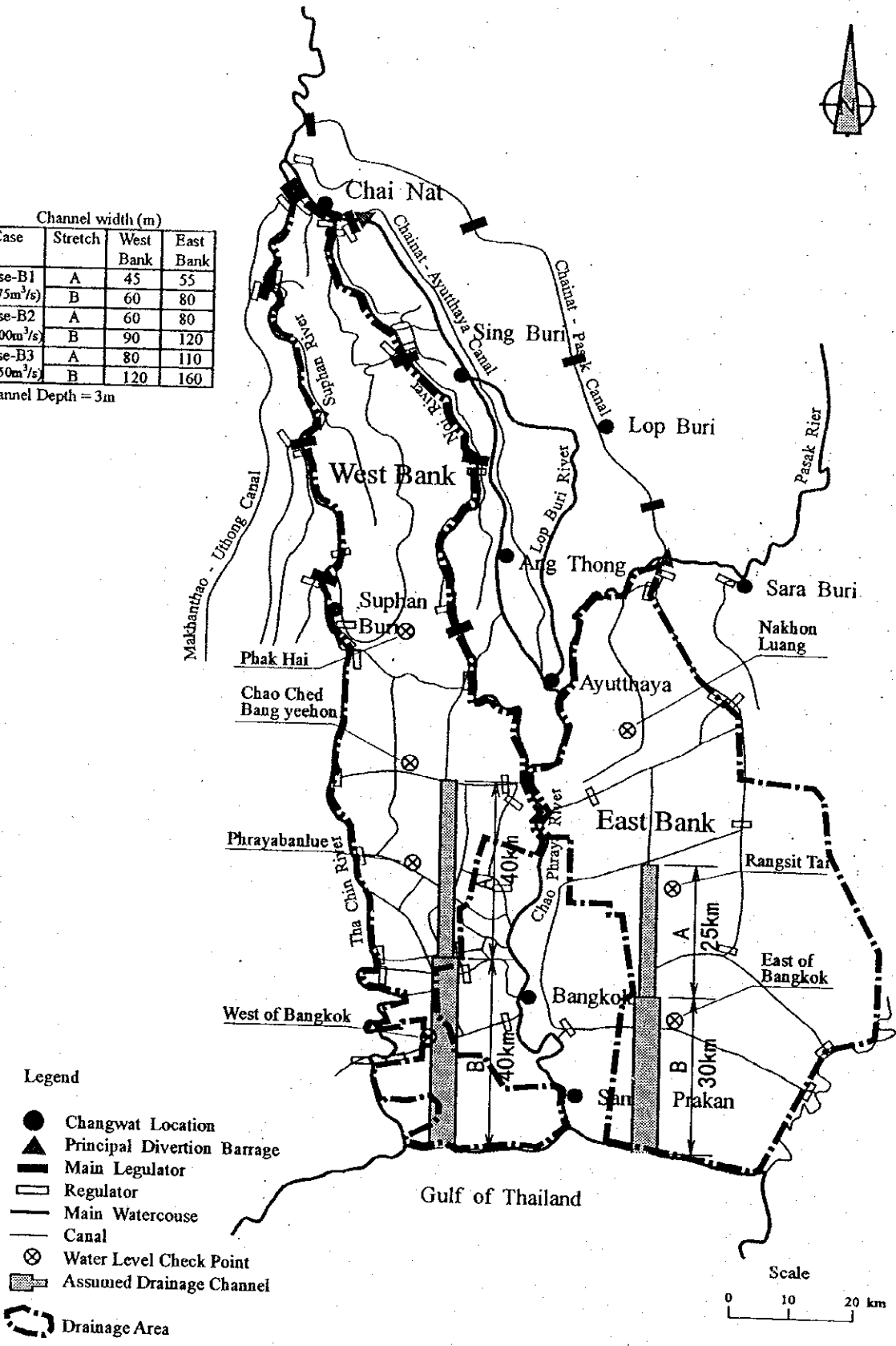
Fig. 4.2.4 (1/2)

ASUMED DRAINAGE CHANNEL

CASE B

Case	Stretch	Channel width (m)	
		West Bank	East Bank
Case-B1 ($Q=75m^3/s$)	A	45	55
	B	60	80
Case-B2 ($Q=100m^3/s$)	A	60	80
	B	90	120
Case-B3 ($Q=150m^3/s$)	A	80	110
	B	120	160

Channel Depth = 3m



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.4¹(2/2)

ASUUMED DRAINAGE CHANNEL

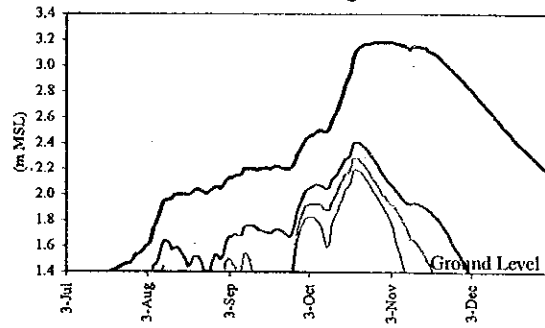
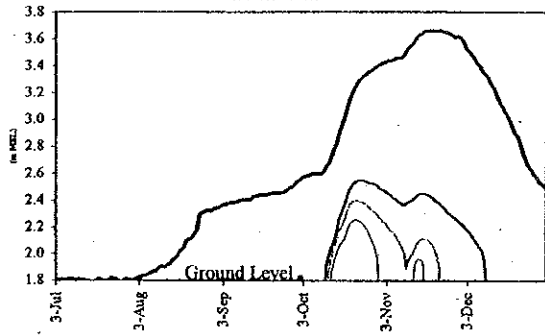
1983

West Bank

East Bank

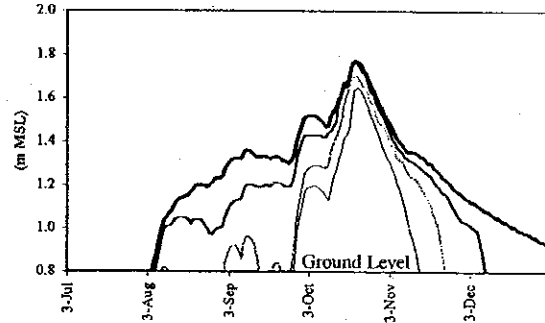
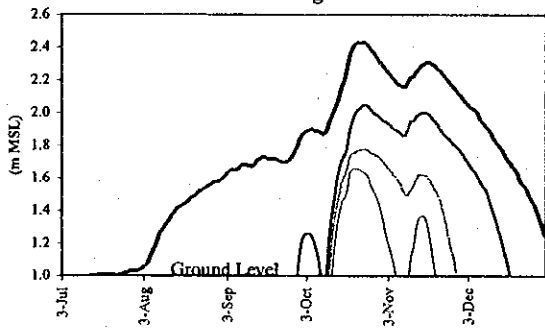
Phak Hai

Nakhon Luang



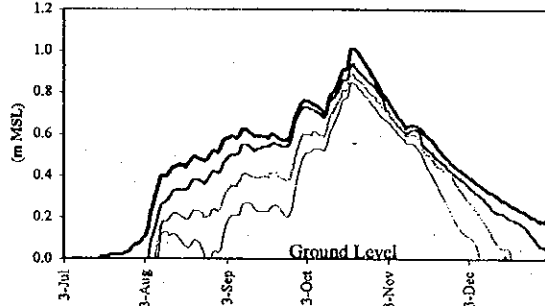
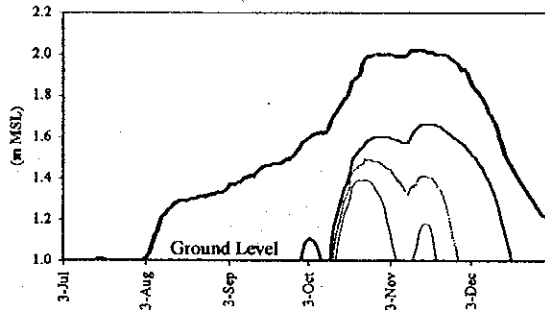
Chao Ched Bang Yeehon

Rangsit Tai

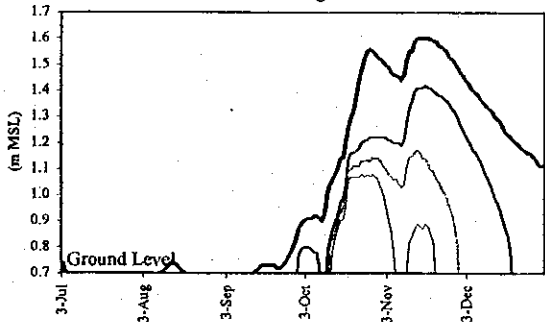


Phrayabanlue

East of Bangkok



West of Bangkok



- Future Basin Condition
- Case-A1
- Case-A2
- Case-A3
- Lowest Ground Level

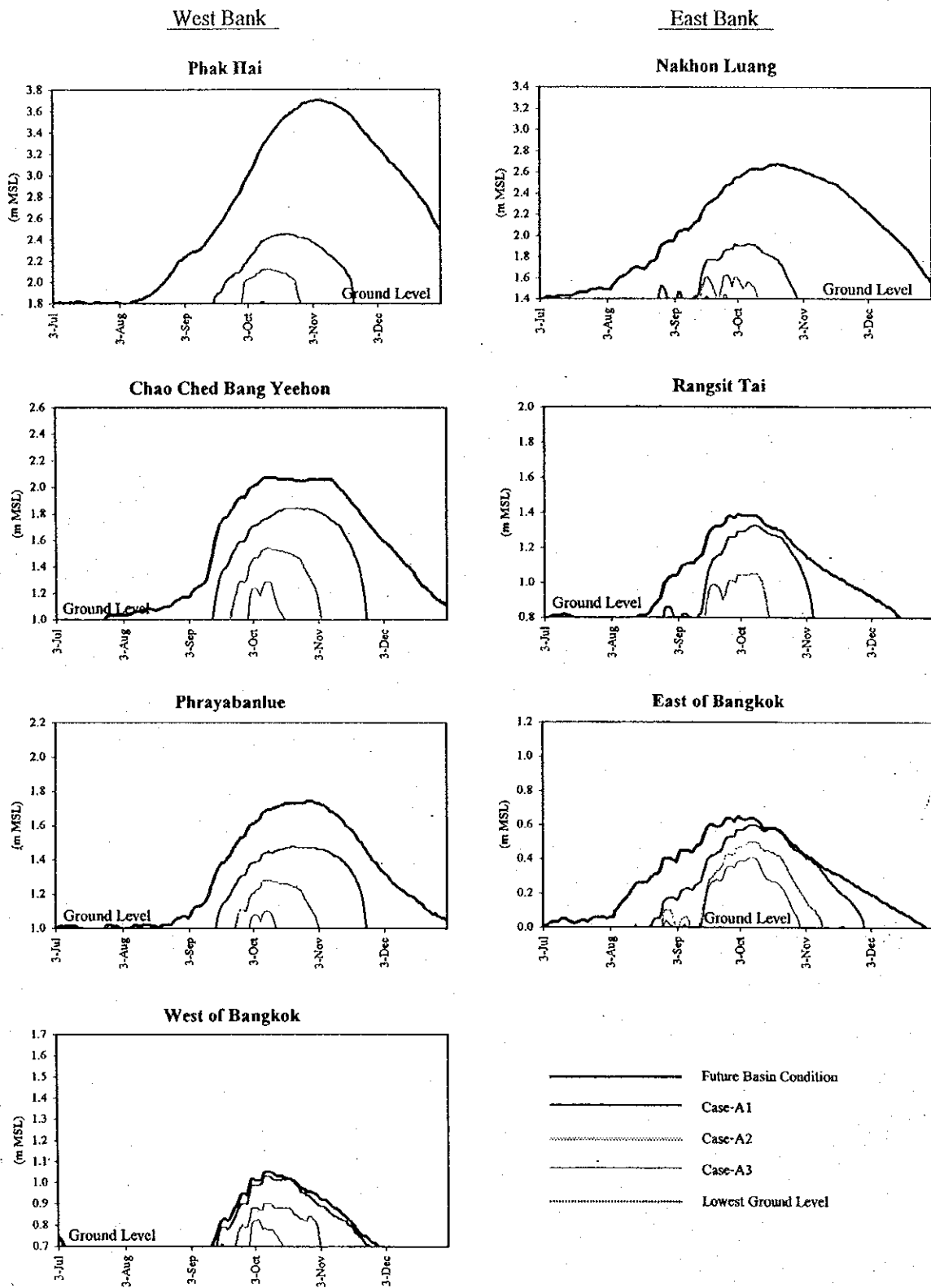
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

Fig. 4.2.5(1/6)

SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

CTI ENGINEERING CO., LTD AND INA CORPORATION

1995



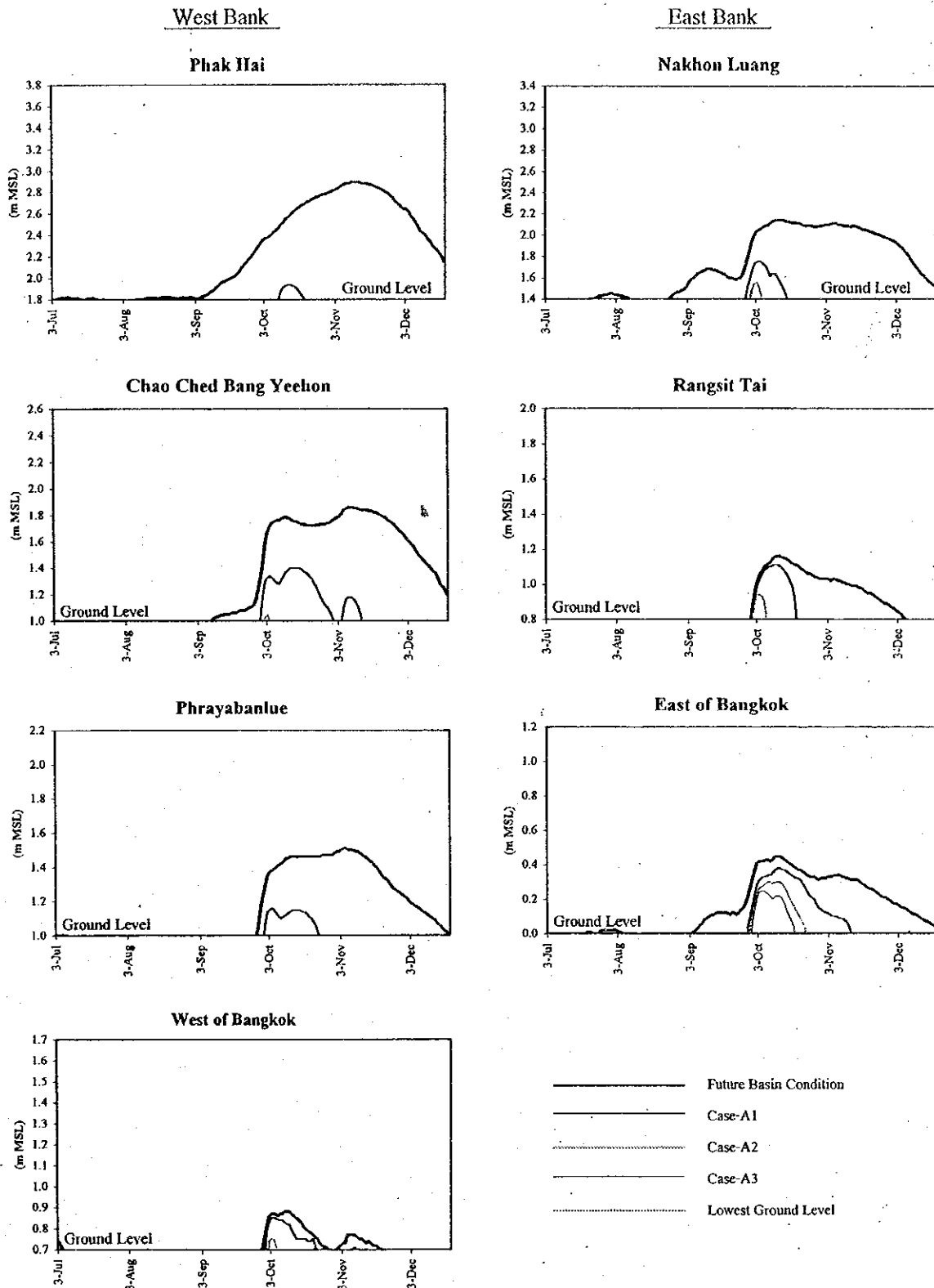
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.5(2/6) 6)

SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

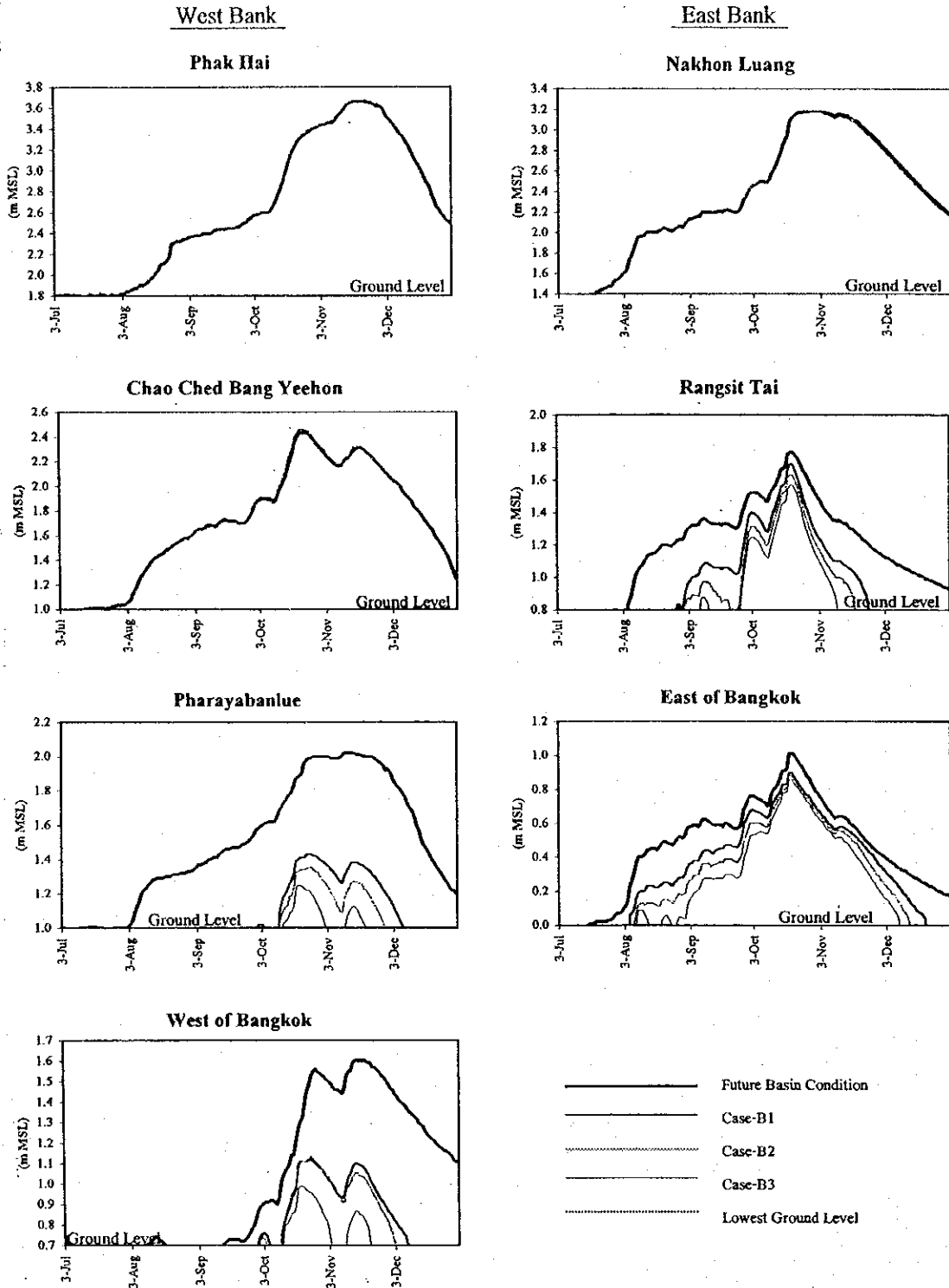
1996



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.5(3/6)
 SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

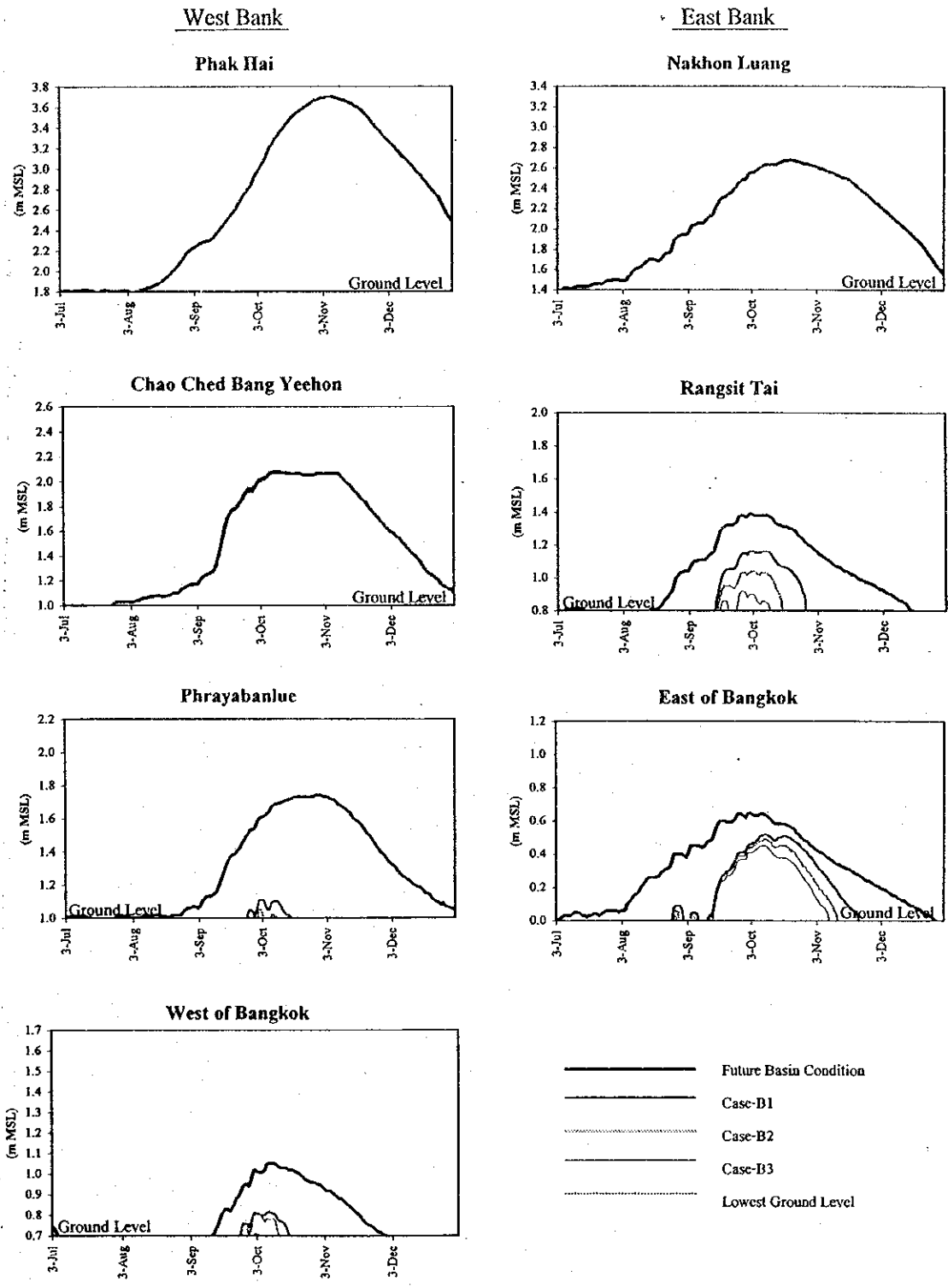
1983



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.5(4/6)
 SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

1995



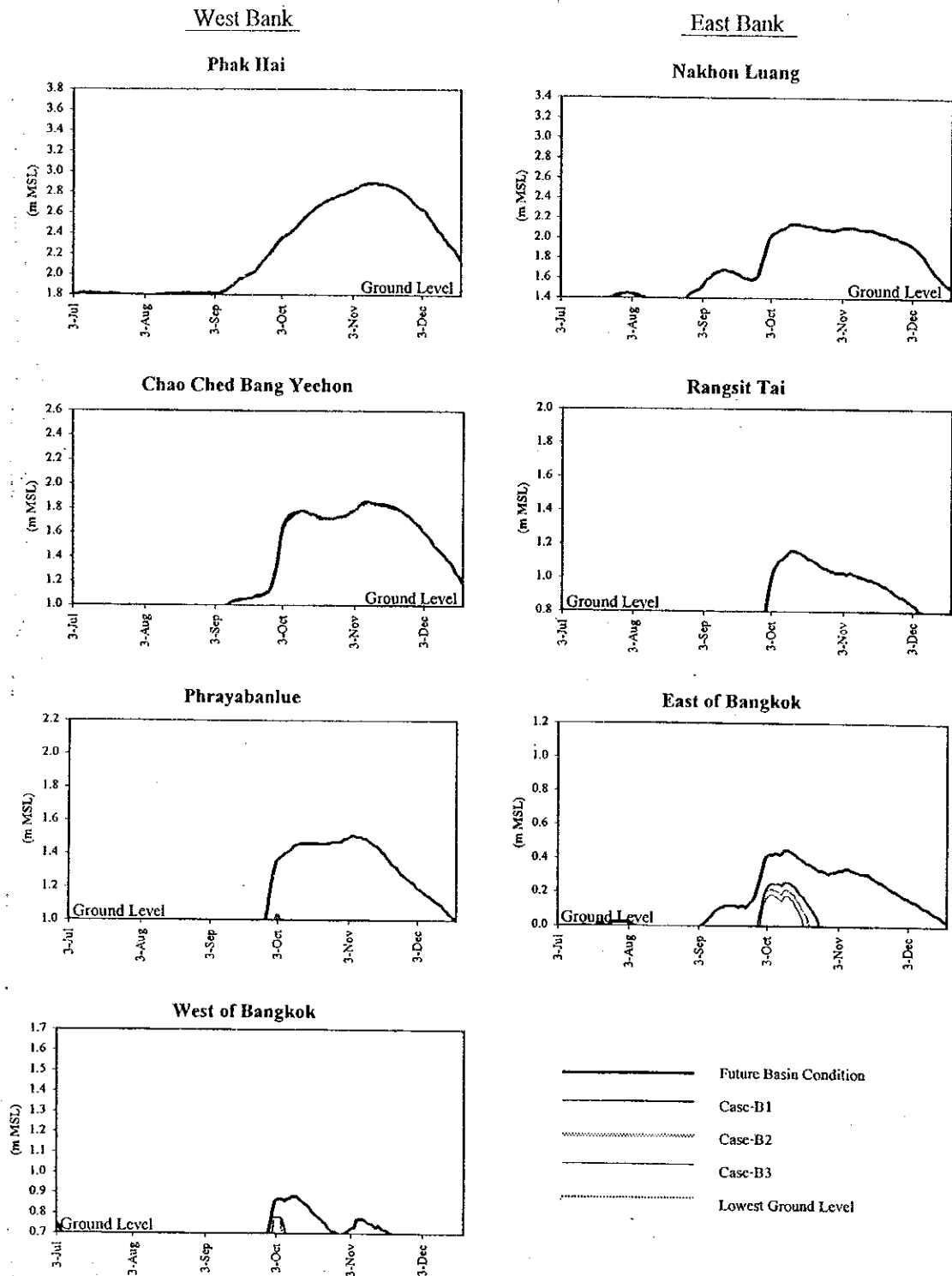
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.5(5/6)

SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

1996



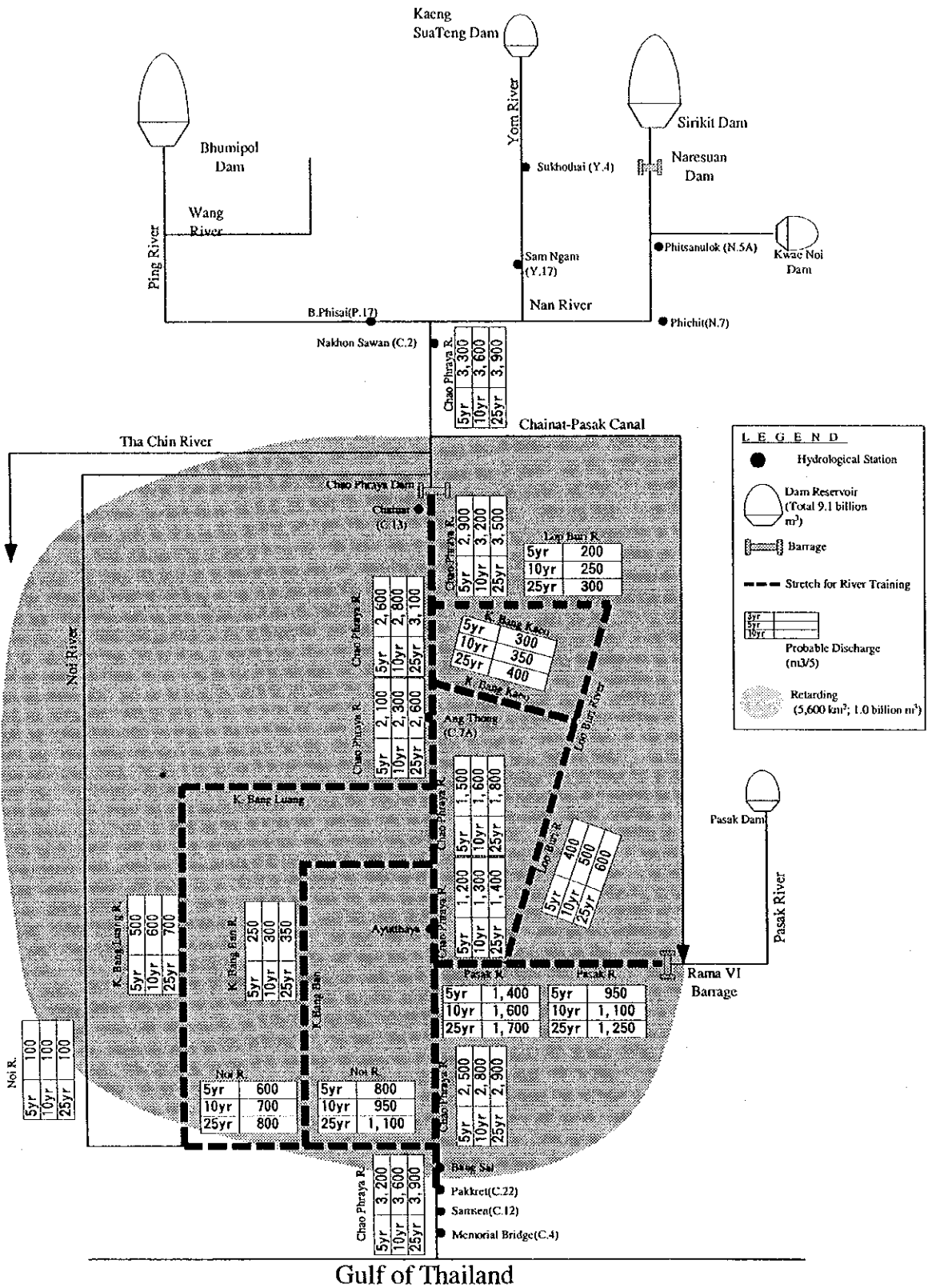
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 4.2.5(6/6)

SIMULATED INUNDATION HYDROGRAPH FOR DRAINAGE CHANNEL IMPROVEMENT

From Chainat to Pathum Thani

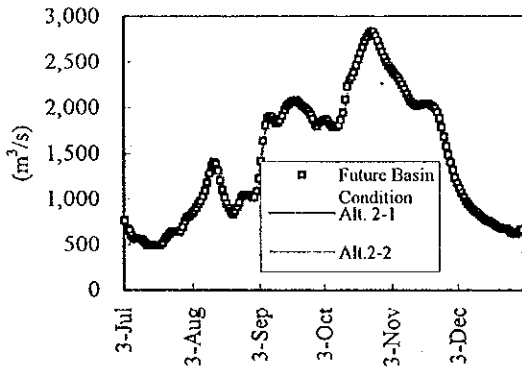


STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

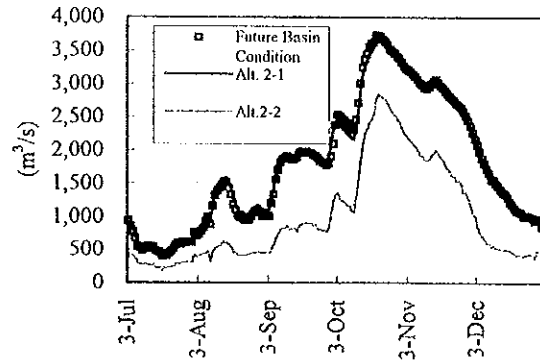
Fig. 4.2.6.(2/2)
 DISCHARGE DISTRIBUTION FOR RIVER
 IMPROVEMENT WITH RETARDING

1983

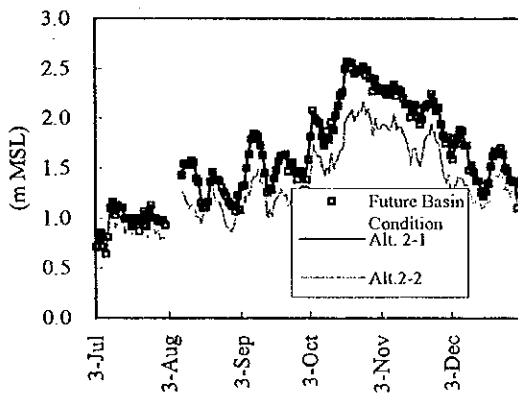
C.2 Daily Mean Discharge



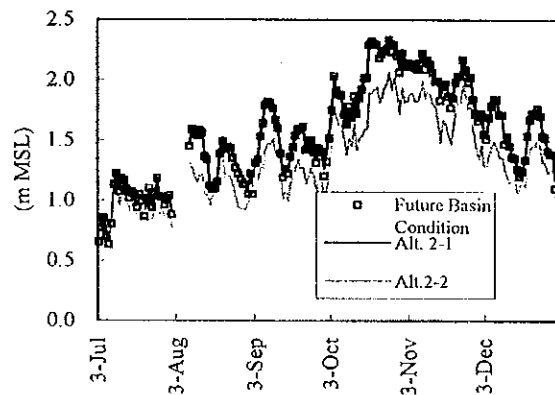
Bang Sai Daily Mean Discharge



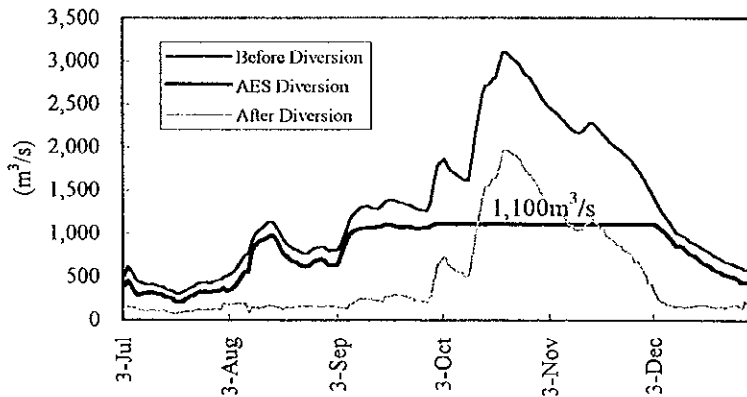
C.12 Daily Maximum Water Level



C.4 Daily Maximum Water Level



Daily Mean Discharge at AES Diversion (Alternative2-2)

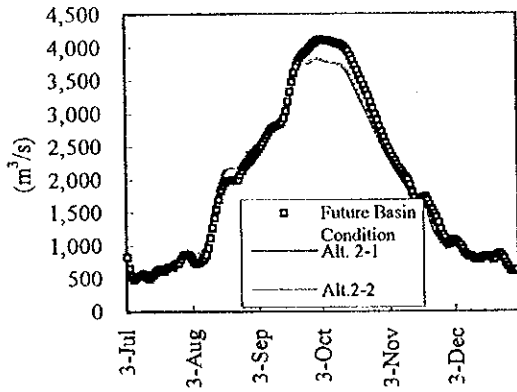


STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

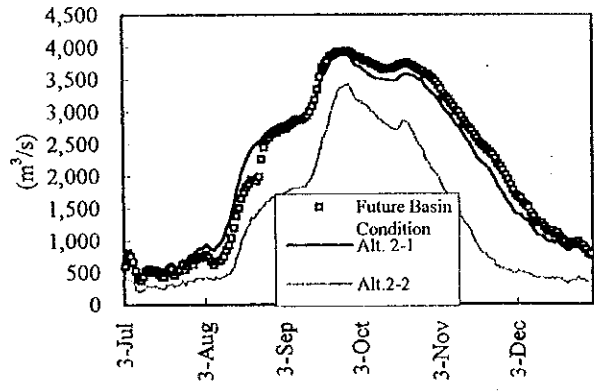
Fig.4.2.7 (1/3) SIMULATED HYDROGRAPH
FOR MASTER PLAN

1995

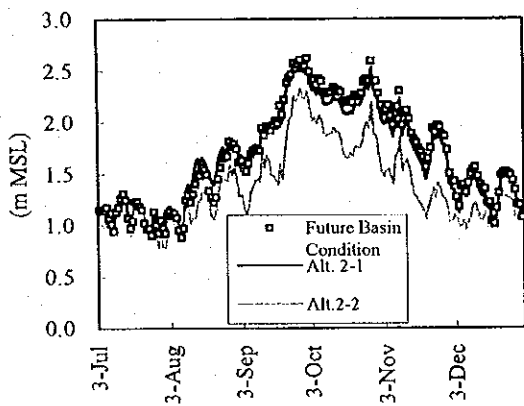
C.2 Daily Mean Discharge



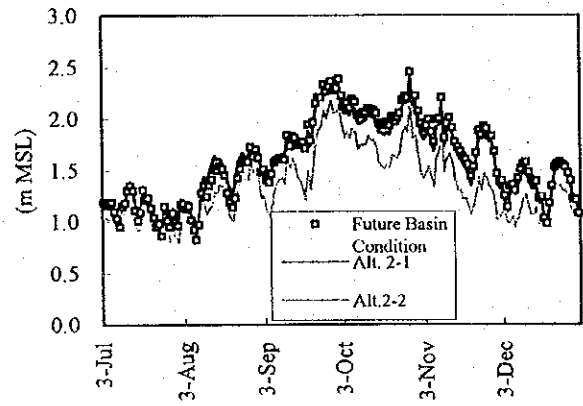
Bang Sai Daily Mean Discharge



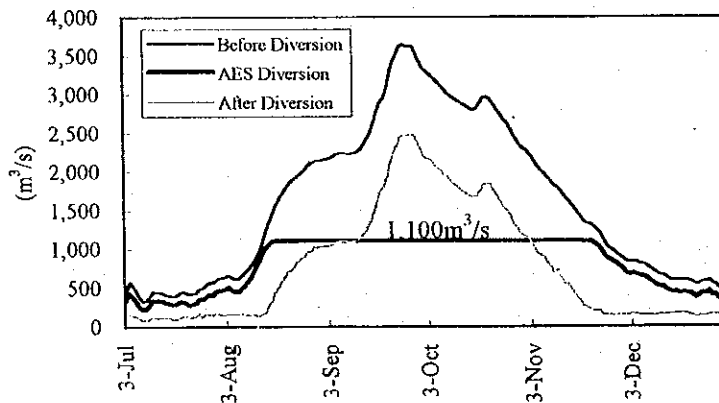
C.12 Daily Maximum Water Level



C.4 Daily Maximum Water Level



Daily Mean Discharge at AES Diversion (Alternative2-2)

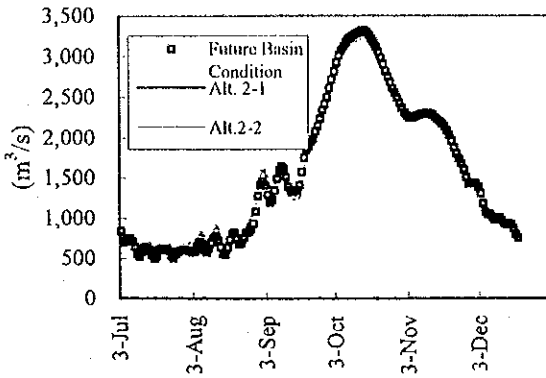


STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

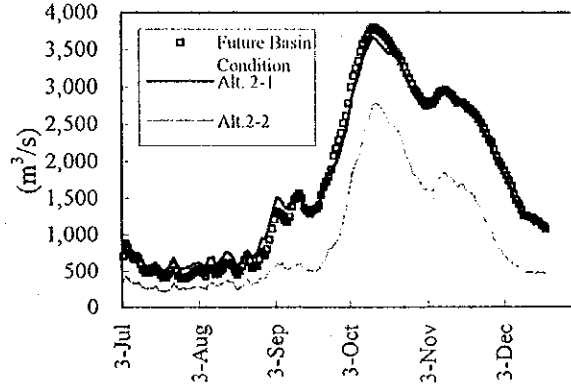
Fig.4.2.7 (2/3) SIMULATED HYDROGRAPH
FOR MASTER PLAN

1996

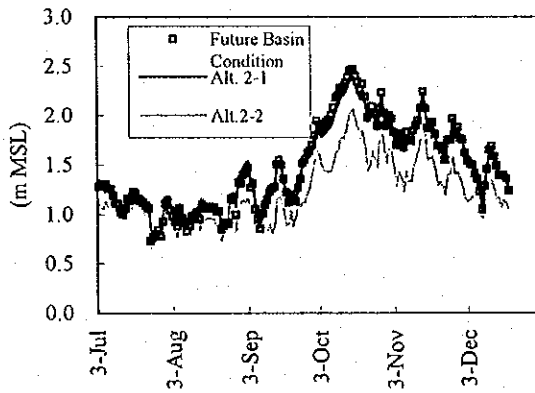
C.2 Daily Mean Discharge



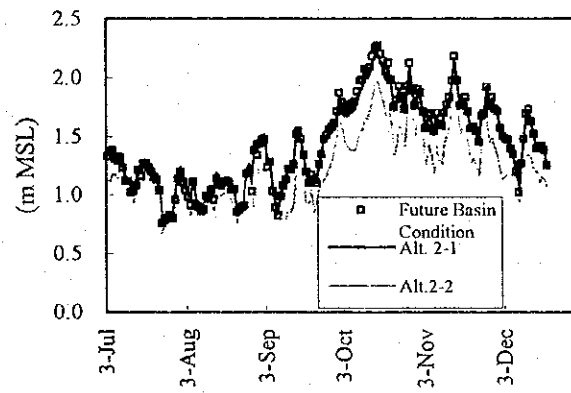
Bang Sai Daily Mean Discharge



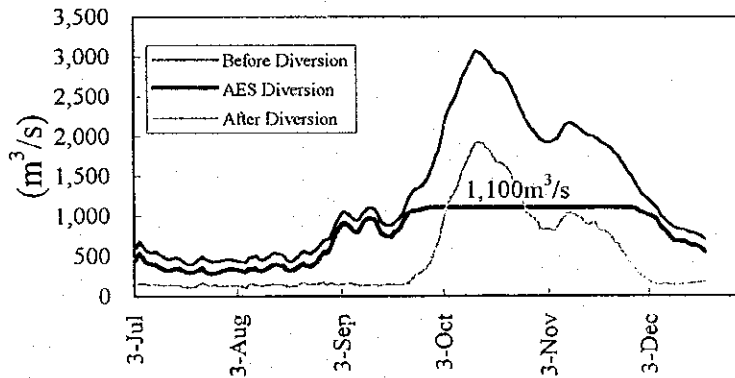
C.12 Daily Maximum Water Level



C.4 Daily Maximum Water Level

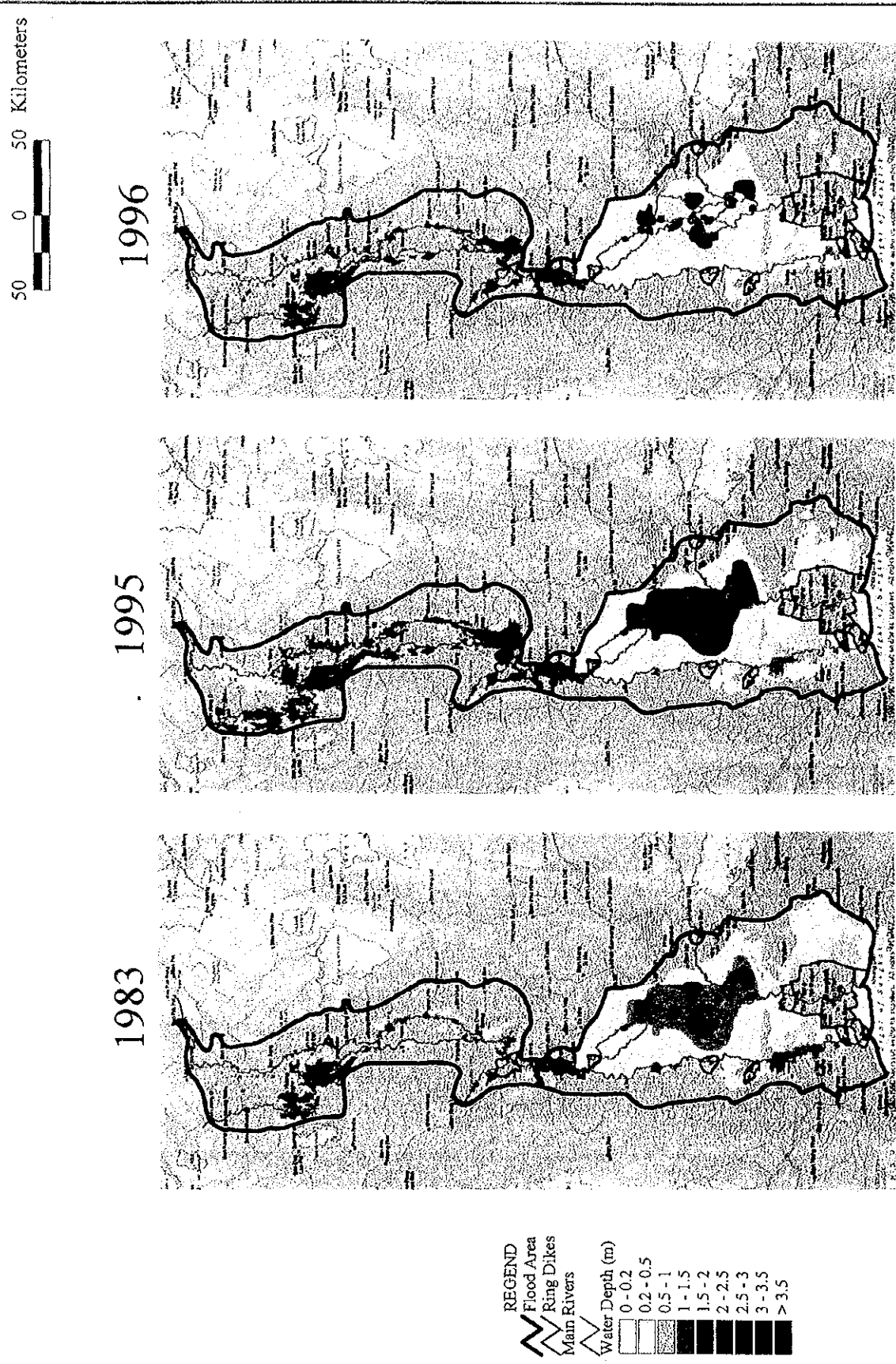


Daily Mean Discharge at AES Diversion (Alternative2-2)



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

Fig.4.2.7 (3/3) SIMULATED HYDROGRAPH
FOR MASTER PLAN



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

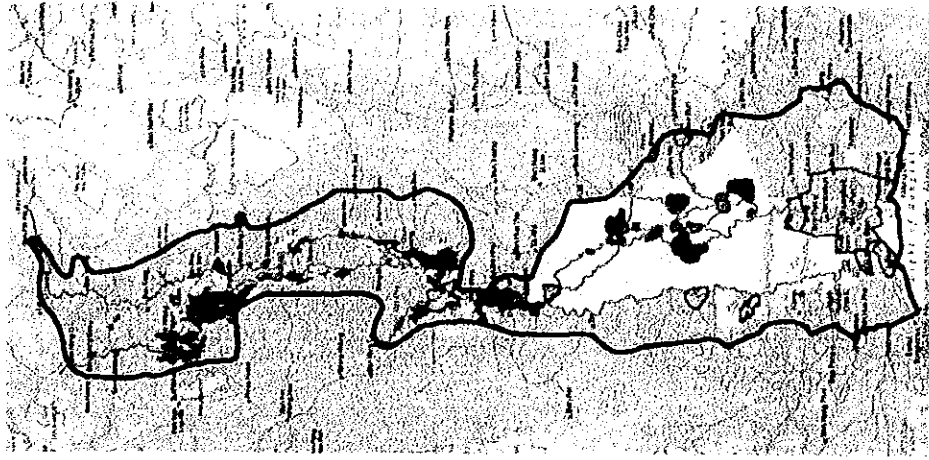
CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.2.8
 SIMULATED FLOOD MAP UNDER ALTERNATIVE 2-1

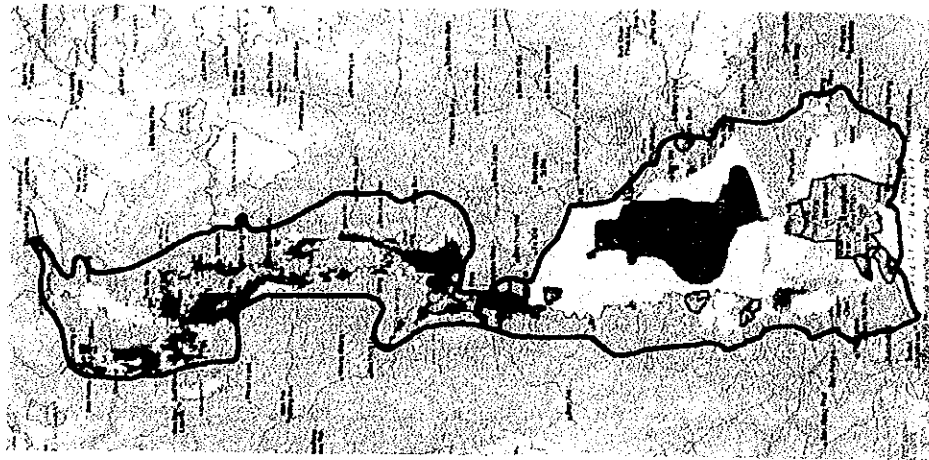
50 0 50 Kilometers



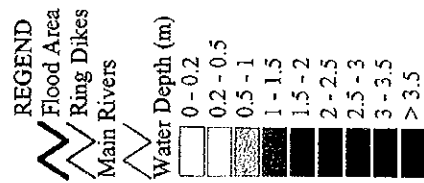
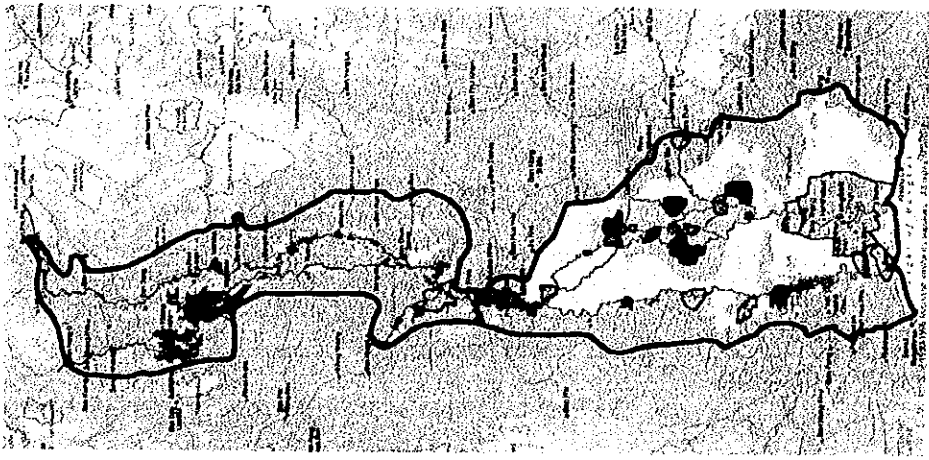
1996



1995



1983

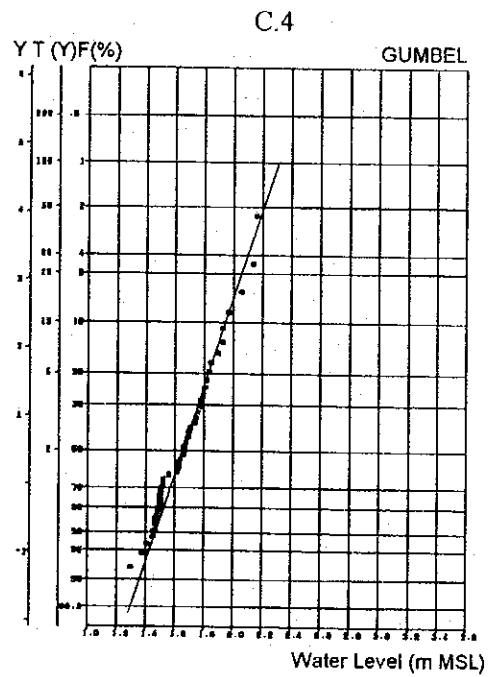
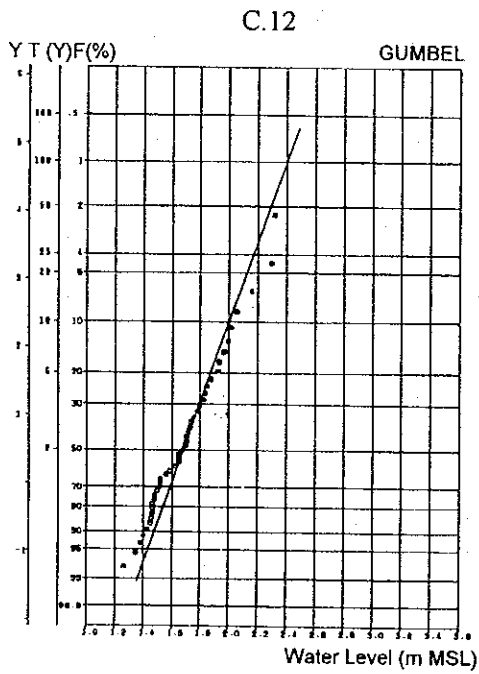
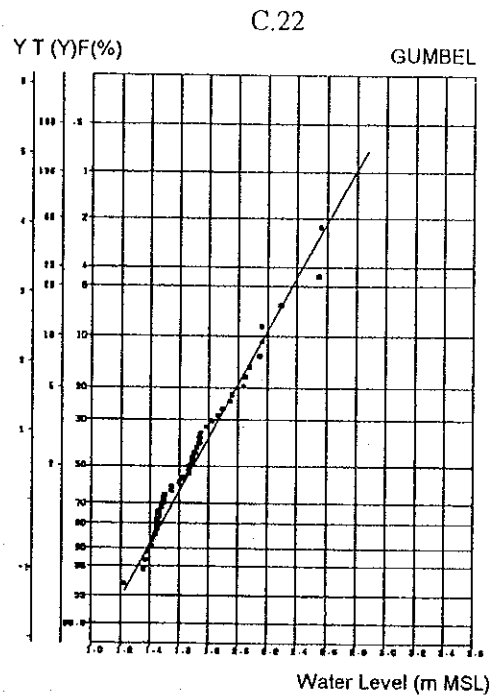
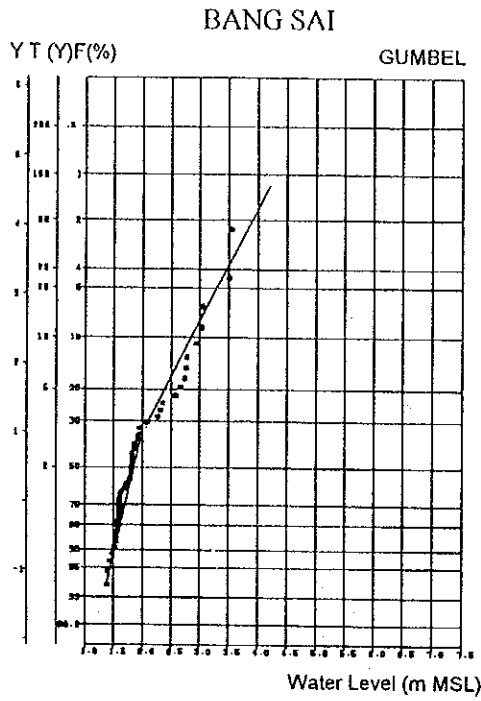


STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.2.9

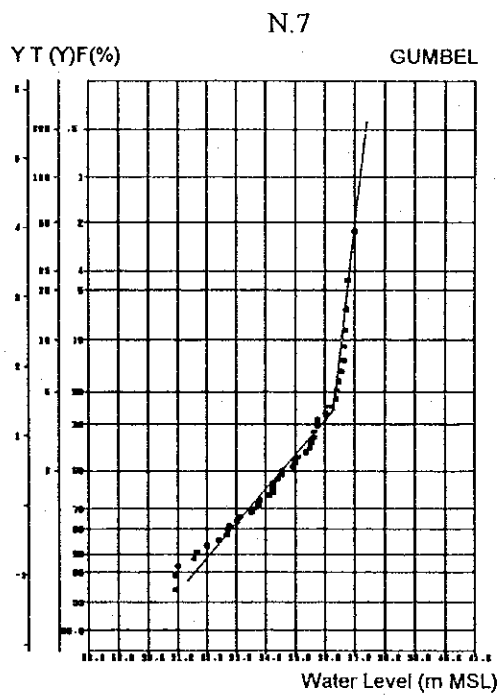
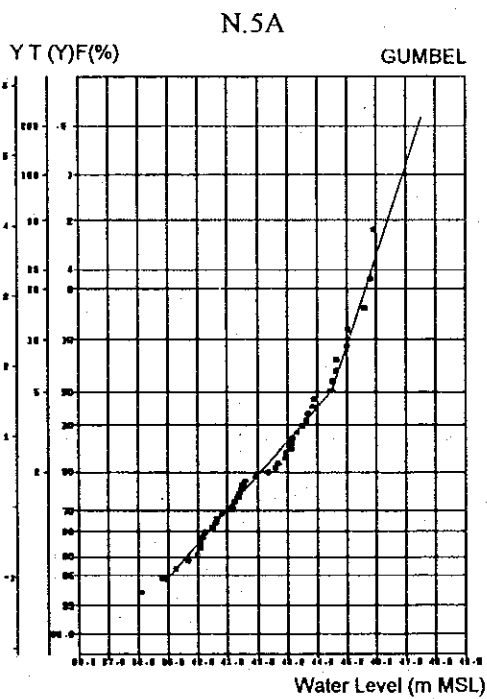
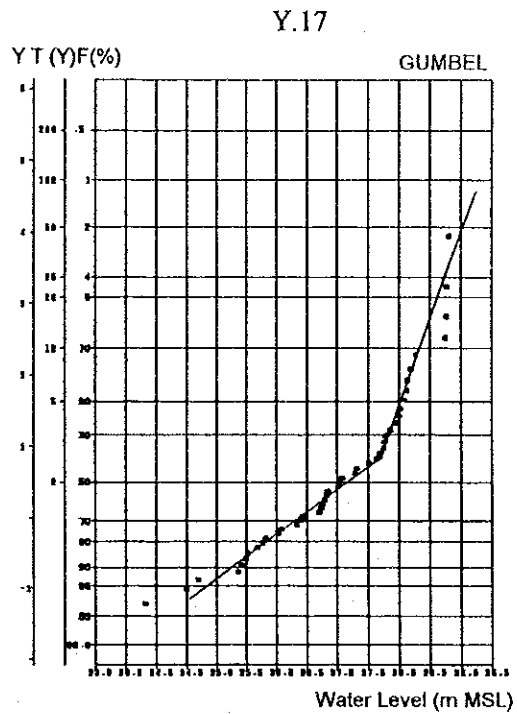
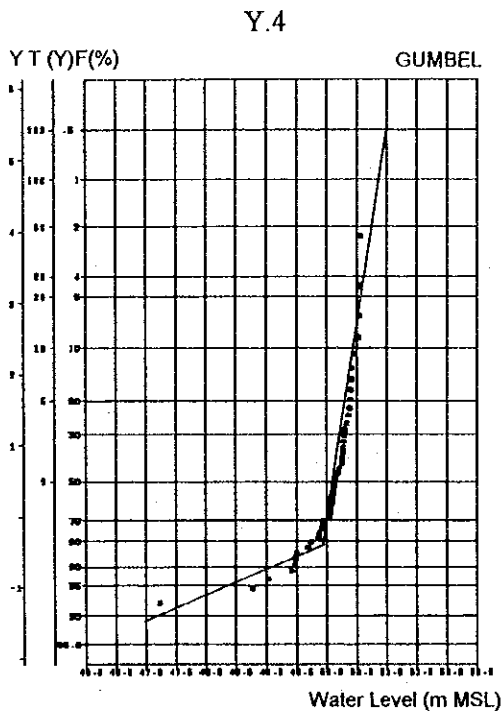
SIMULATED FLOOD MAP UNDER ALTERNATIVE 2-2



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

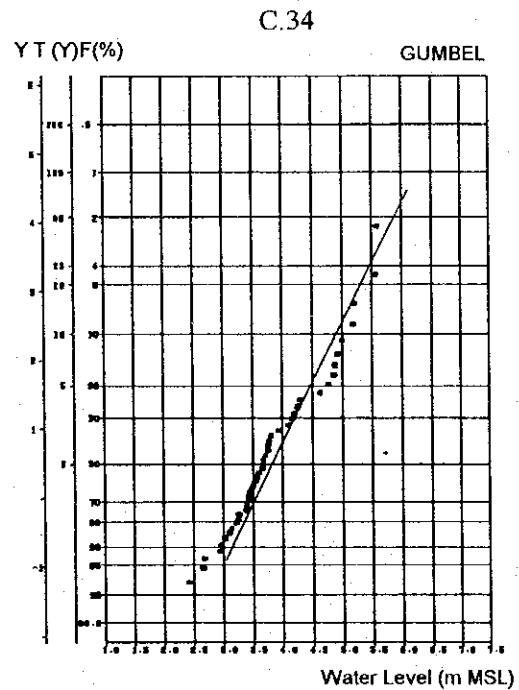
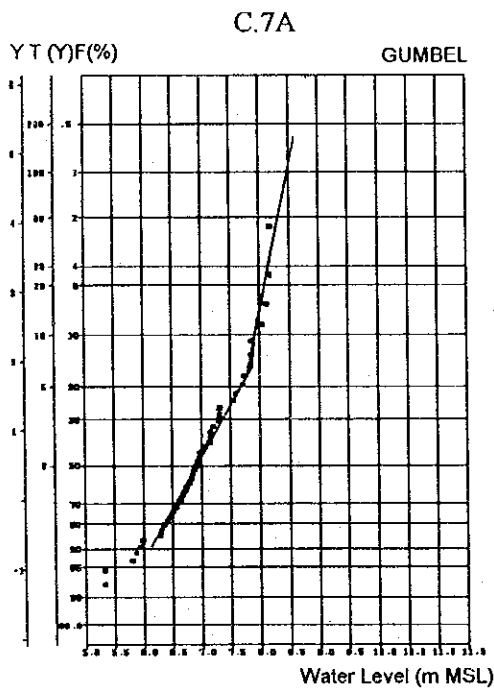
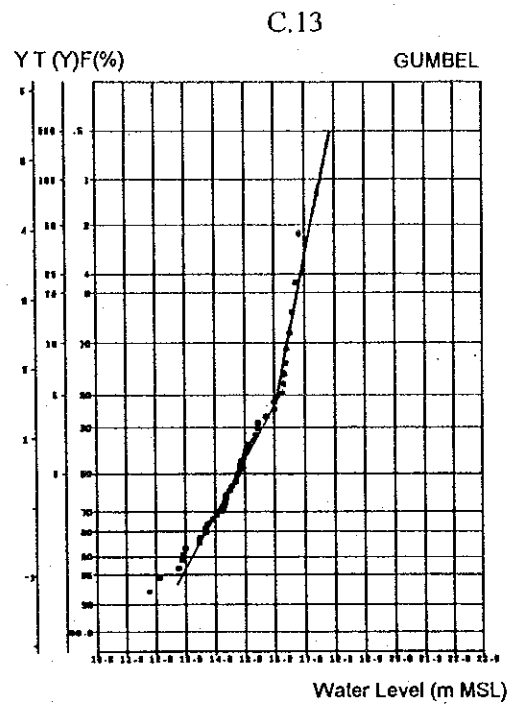
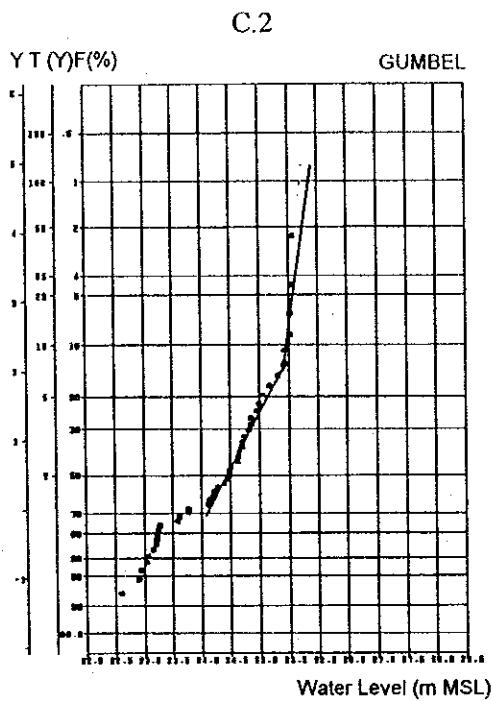
Fig. 4.2.10(1/3)
PLOTING OF WATER LEVELS
UNDER ALTERNATIVE 2-2



STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

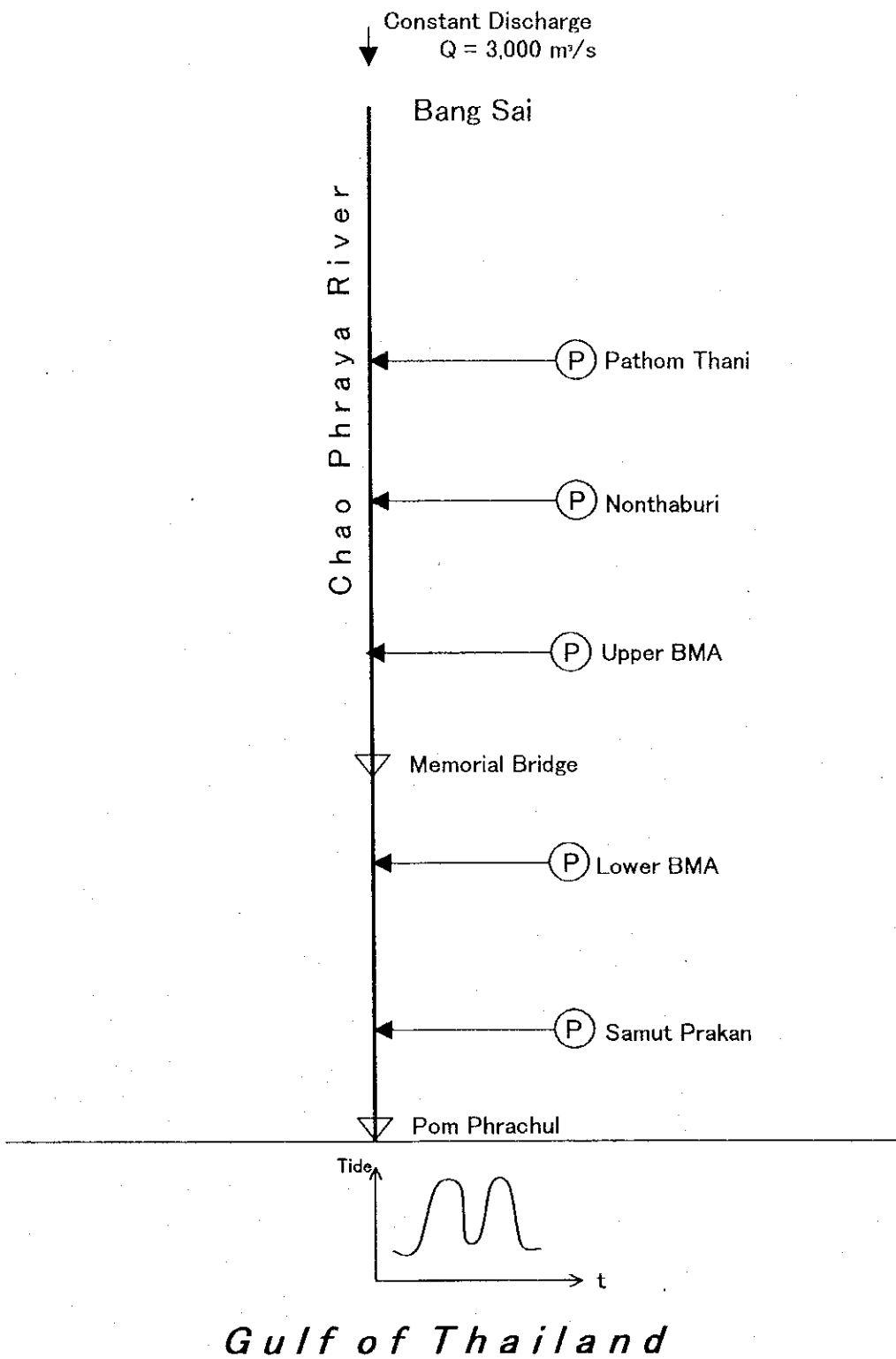
Fig. 4.2.10(2/3)
PLOTING OF WATER LEVELS
UNDER ALTERNATIVE 2-2



STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

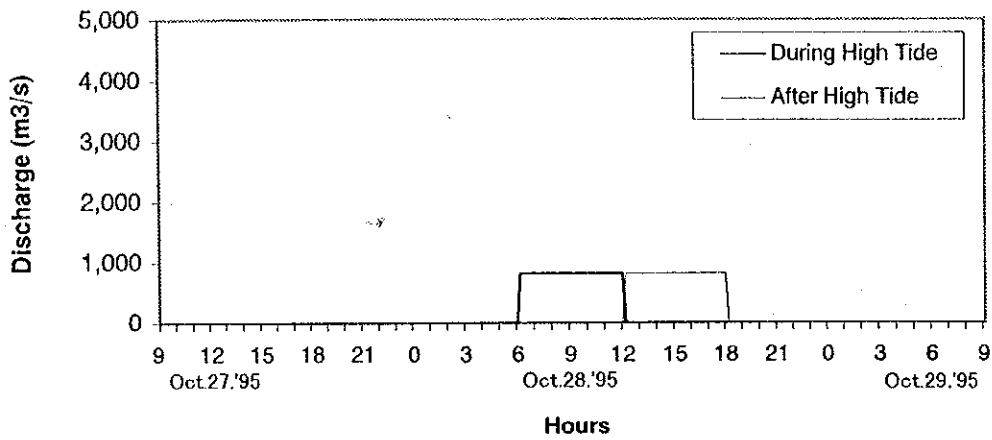
Fig. 4.2.10(3/3)
PLOTING OF WATER LEVELS
UNDER ALTERNATIVE 2-2



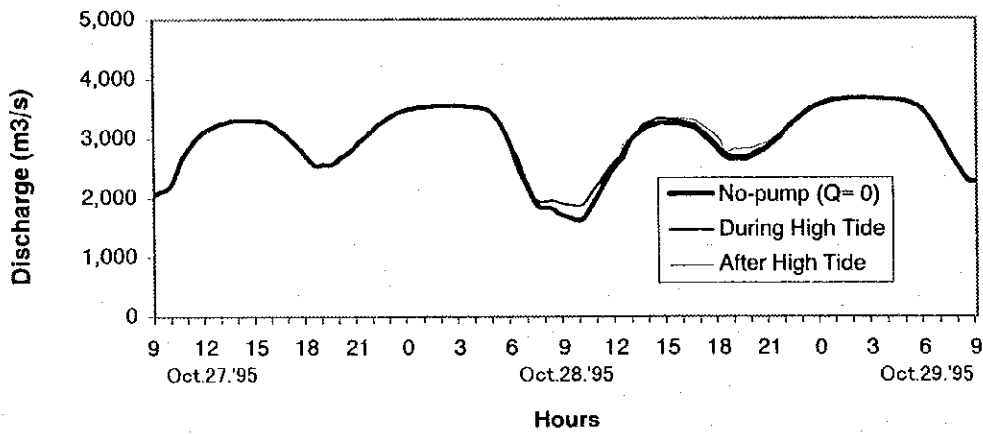
STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.3.1
 SCHEMATIC DIAGRAM OF
 PUMP DRAIN MODEL

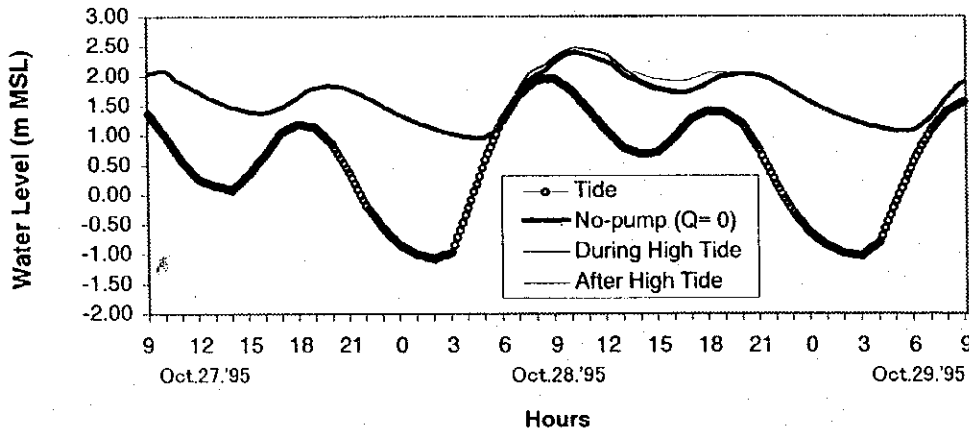
Pump Discharge



Discharge at Memorial Bridge



Water Level at Memorial Bridge



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN

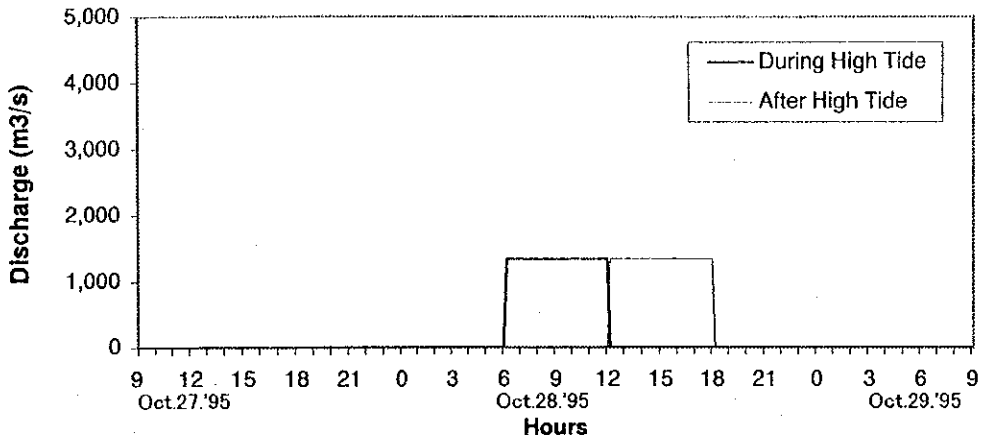
CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 4.3.2(1/2)

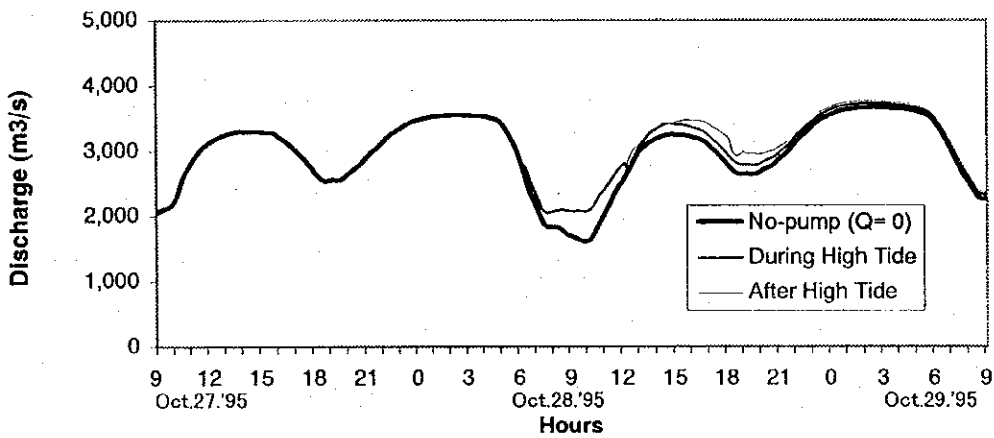
INFLUENCE OF PUMP DRAIN TO CHAO

PHRAYARIVER (PRESENT PUMP CAPACITY)

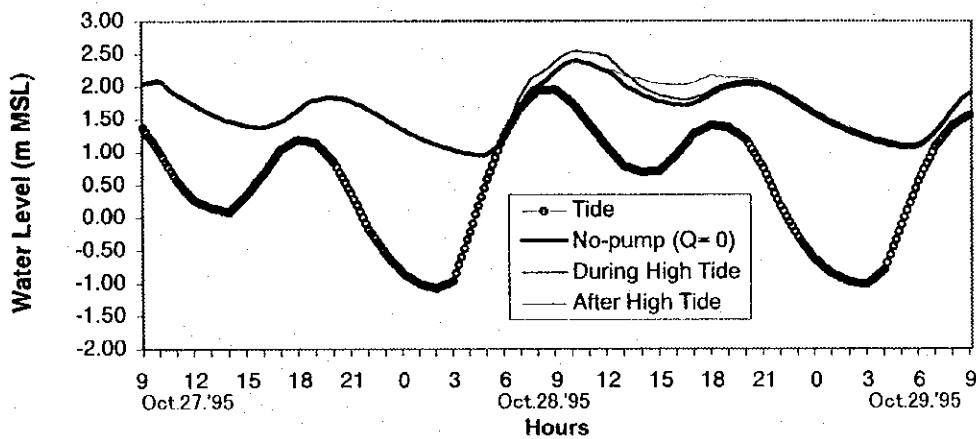
Pump Discharge



Discharge at Memorial Bridge

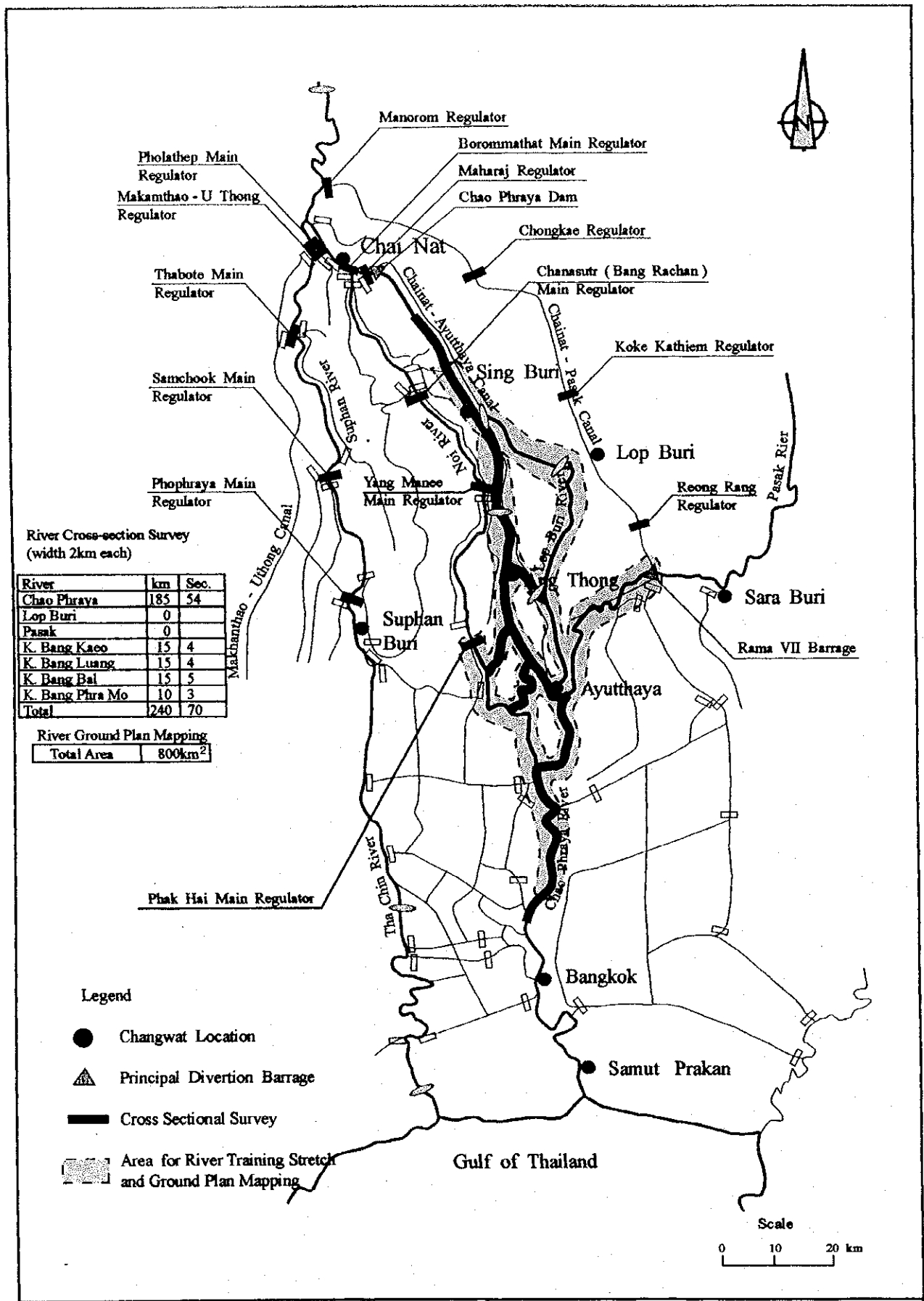


Water Level at Memorial Bridge



STUDY ON ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAOPHRAYA RIVER BASIN
CTI ENGINEERING CO., LTD & INA CORPORATION

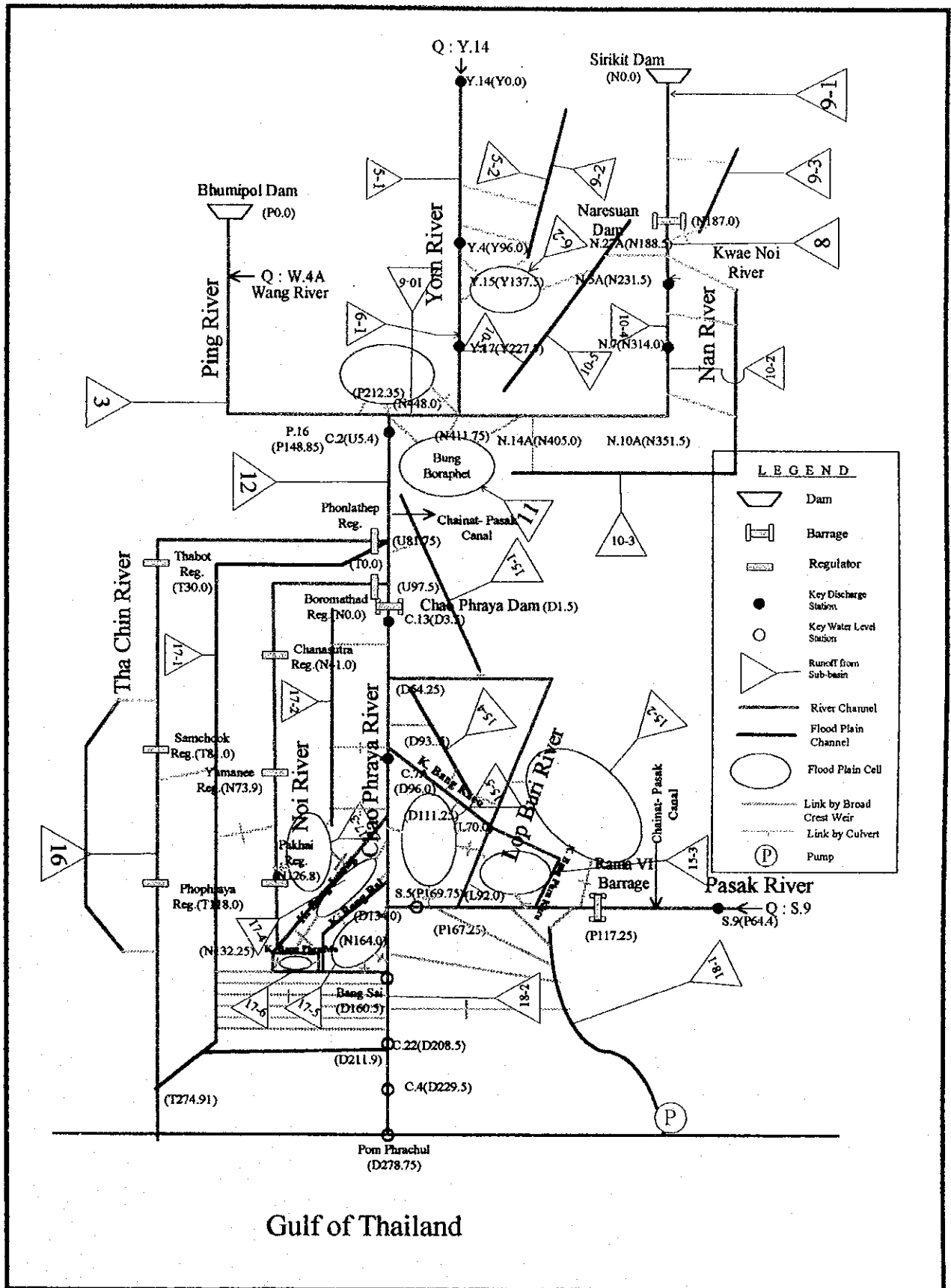
Fig. 4.3.2(2/2)
INFLUENCE OF PUMP DRAIN TO CHAO
PHRAYARIVER (FUTURE PUMP CAPACITY)



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

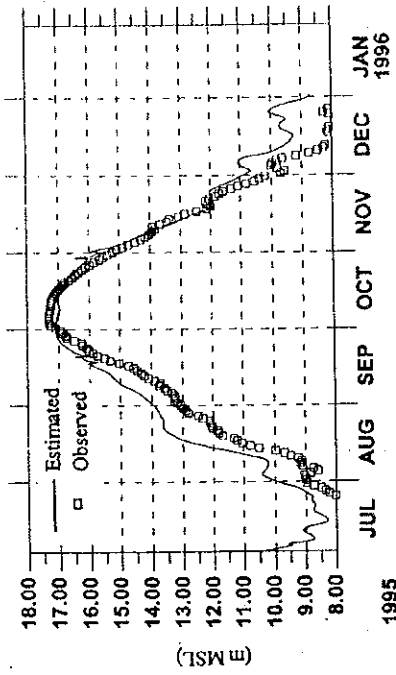
Fig. 5.1.1
RIVER SURVEY
IN FEASIBILITY STUDY AREA



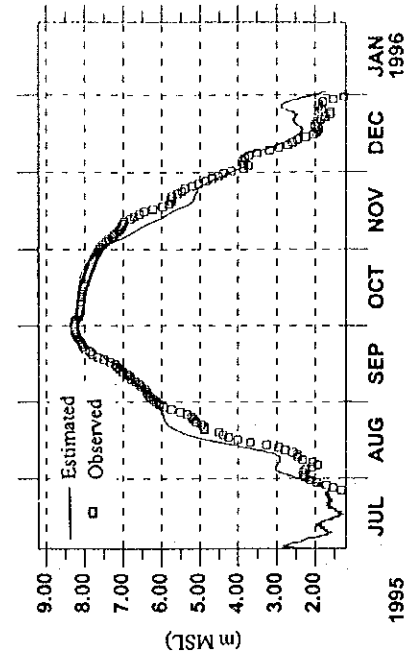
STUDY ON ON INTEGRATED PLAN FOR FLOOD
 MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD & INA CORPORATION

Fig. 5.1.2 SCHEMATIC DIAGRAM OF
 FLOOD SIMULATION MODEL

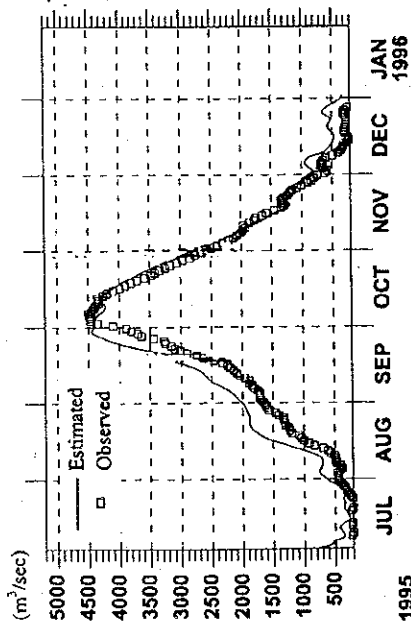
C.13 Water Level



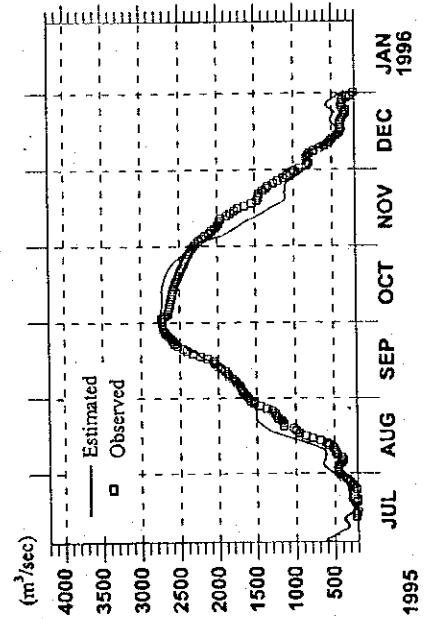
C.7A Water Level



C.13 Discharge



C.7A Discharge

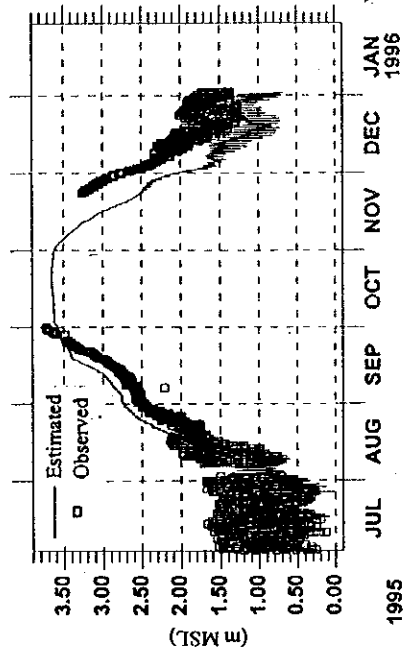


STUDY ON INTEGRATED PLAN FOR FLOOD
MITIGATION IN CHAO PHRAYA RIVER BASIN

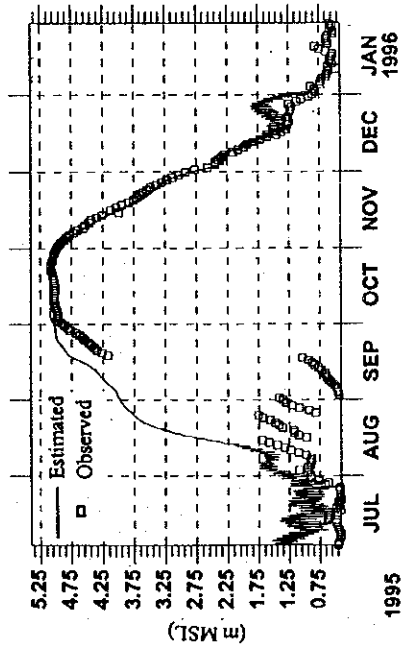
CTI ENGINEERING CO., LTD. AND INA CORPORATION

[Fig. 5.1.3(1/3)
RESULT OF 1995 FLOOD SIMULATION

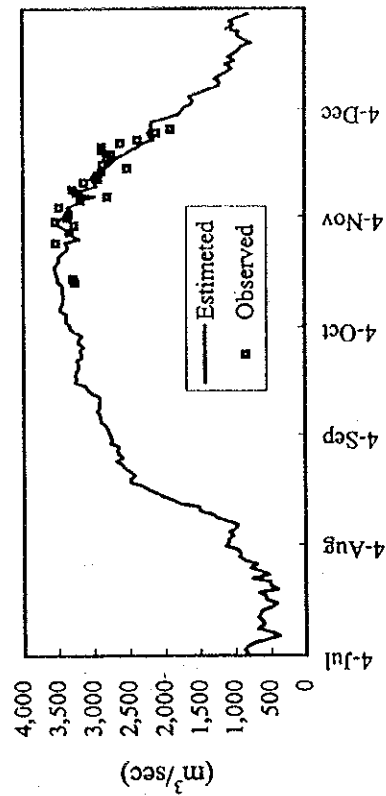
Bang Sai Water Level



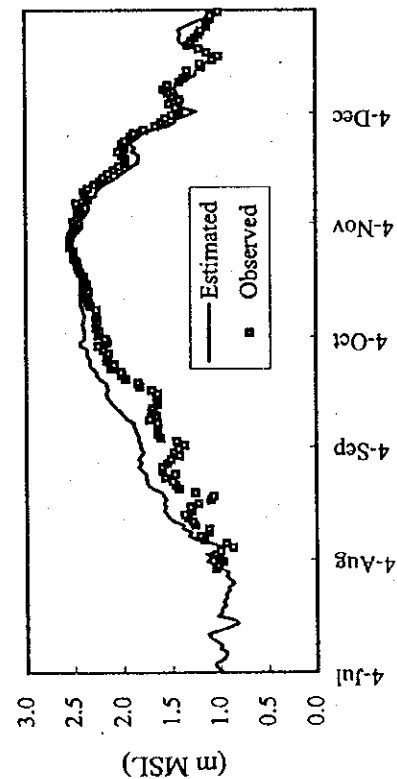
C.34 Water Level



Daily Maen Discharge at Phranang Klao Bridge



C.22 Daily Maximum Water Level



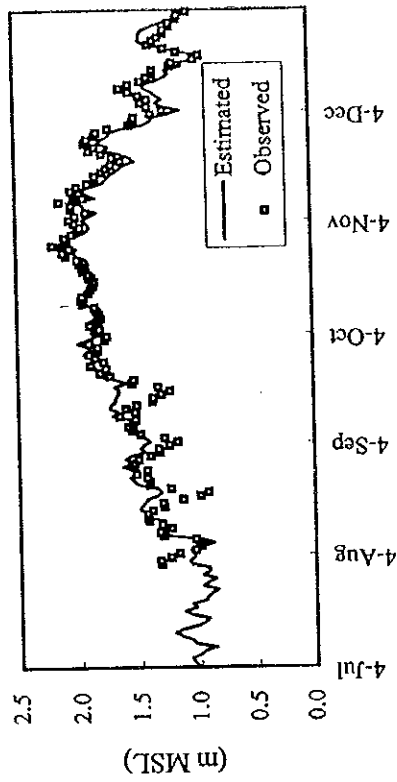
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD. AND INA CORPORATION

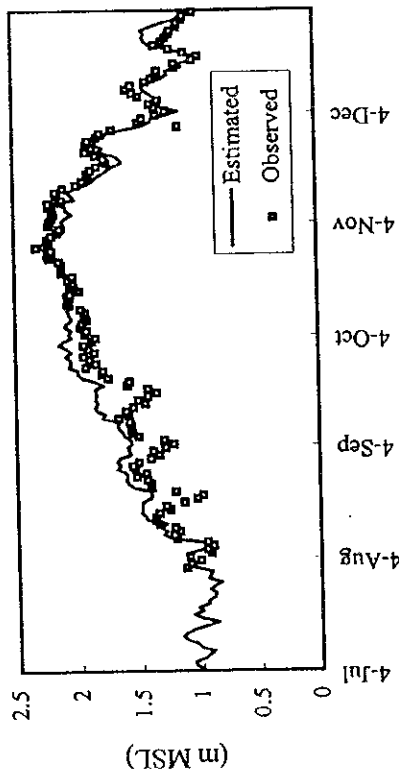
Fig. 5.1.3(2/3)

RESULT OF 1995 FLOOD SIMULATION

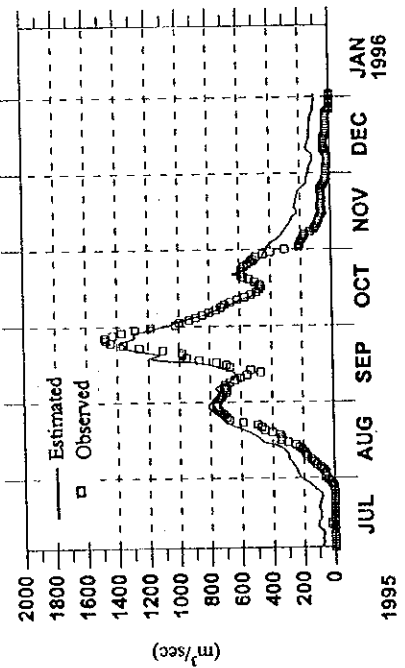
C.4 Daily Maximum Water Level



C.12 Daily Maximum Water Level



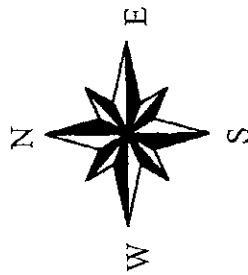
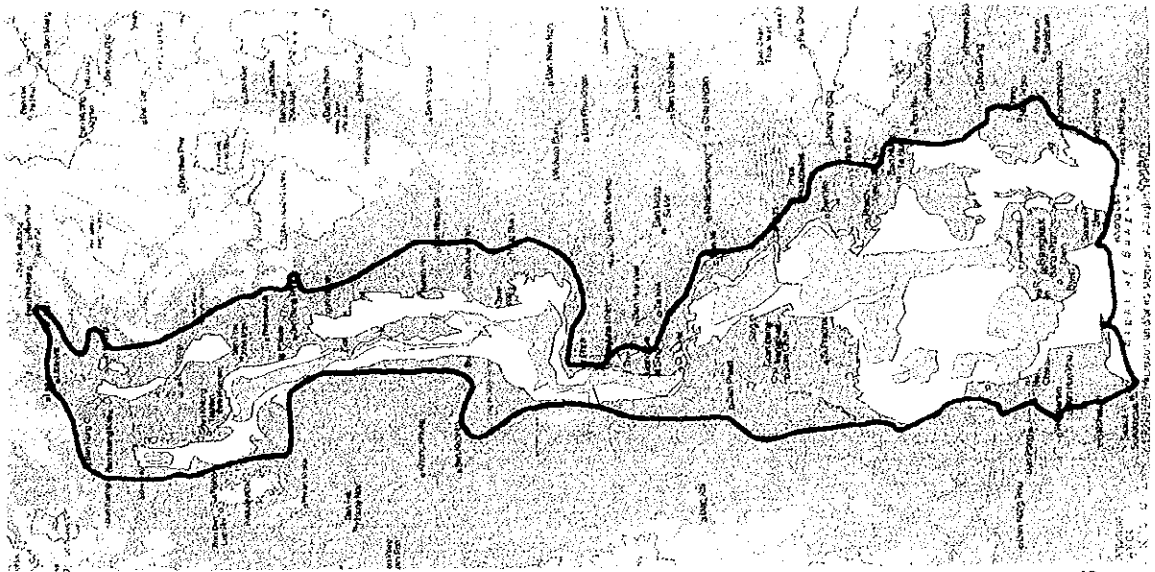
Rama VI Barrage Discharge



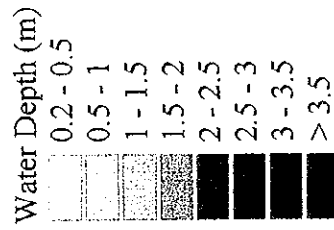
STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN
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Fig. 5.1.3(3/3)
RESULT OF 1995 FLOOD SIMULATION

FLOOD MAP BASED ON SATELLITE IMAGES AND INTERVIEW SURVEY

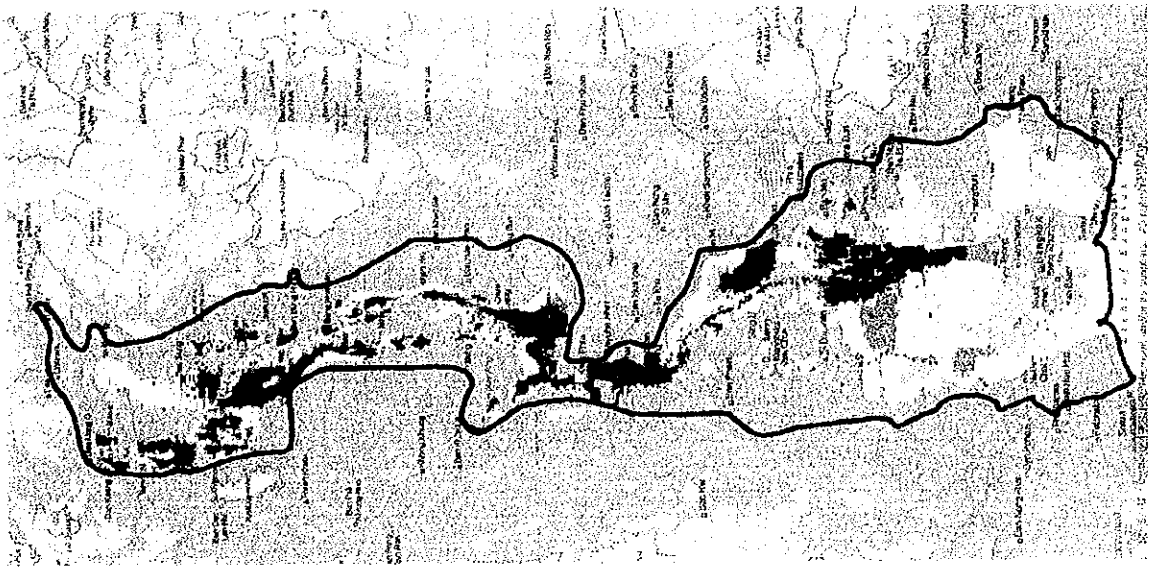


REGEND
 Flood area
 Water Depth $\geq 1m$
 Water Depth $< 1m$



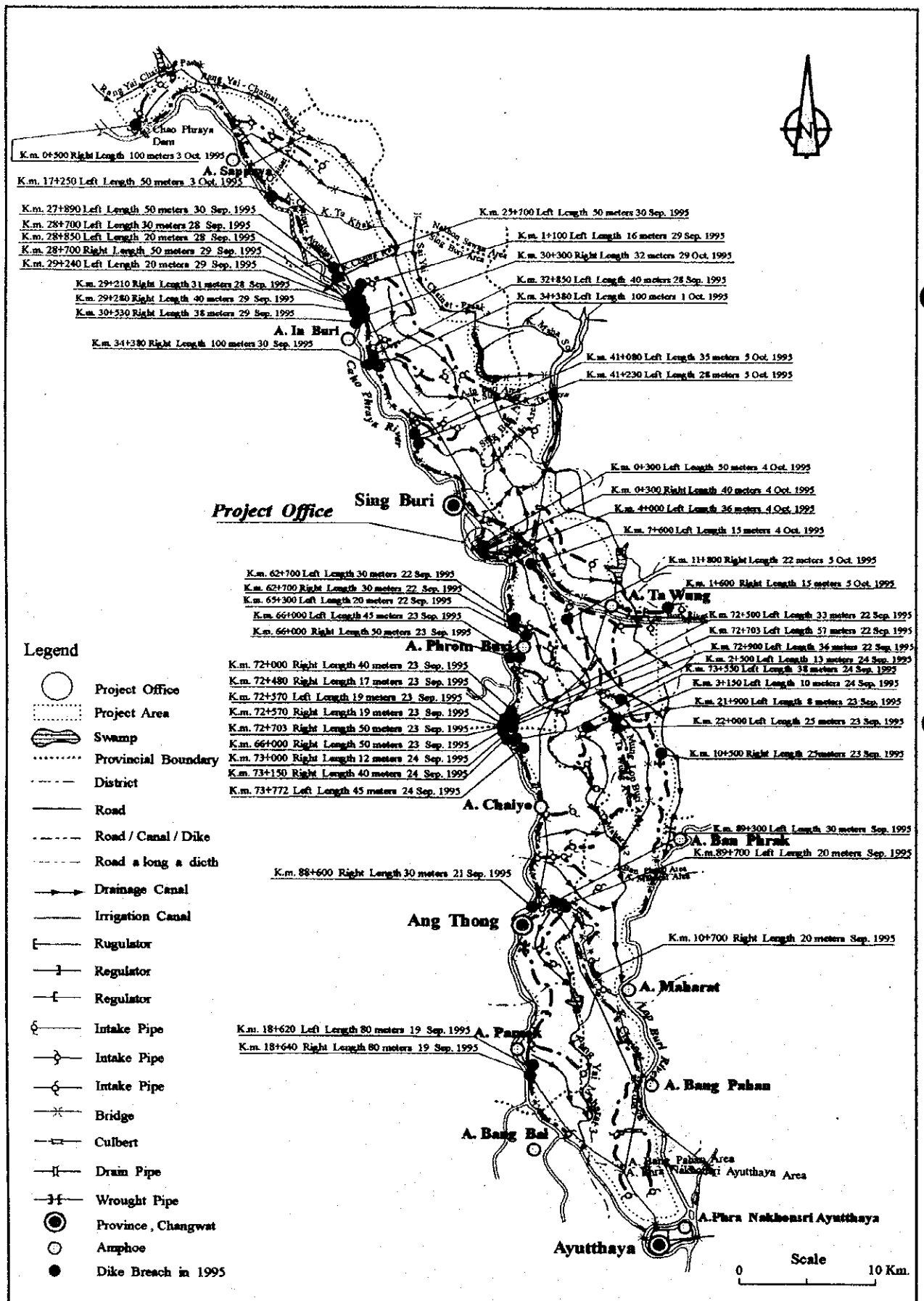
50 0 50 Kilometers

SIMULATED FLOOD MAP



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN
 CTI ENGINEERING CO., LTD. AND INA CORPORATION

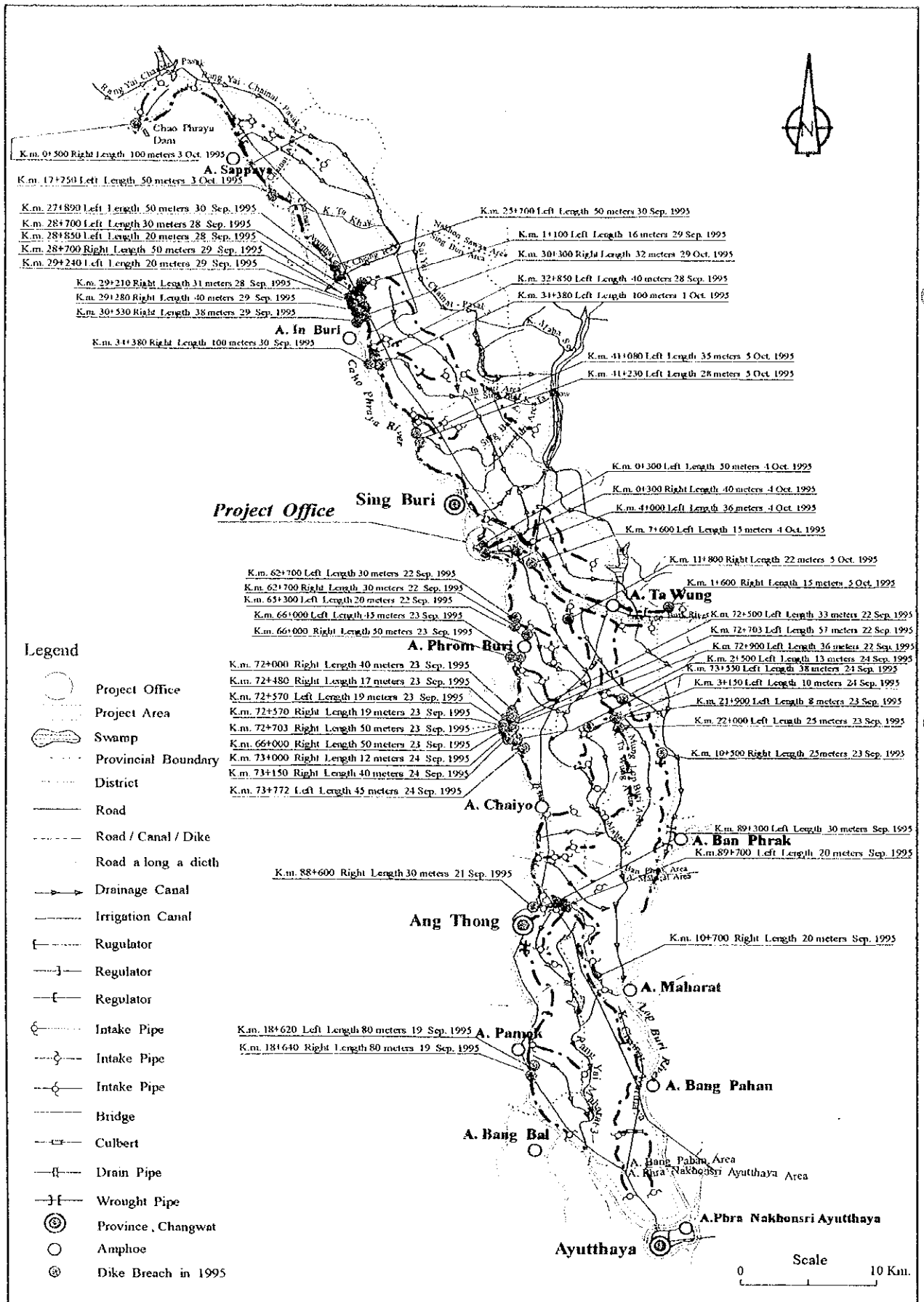
Fig. 5.14
 FLOOD MAP FOR 1995 FLOOD



STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

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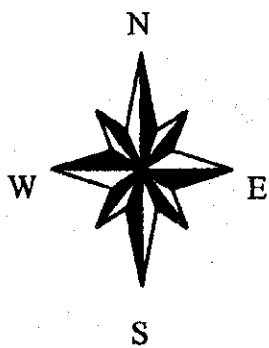
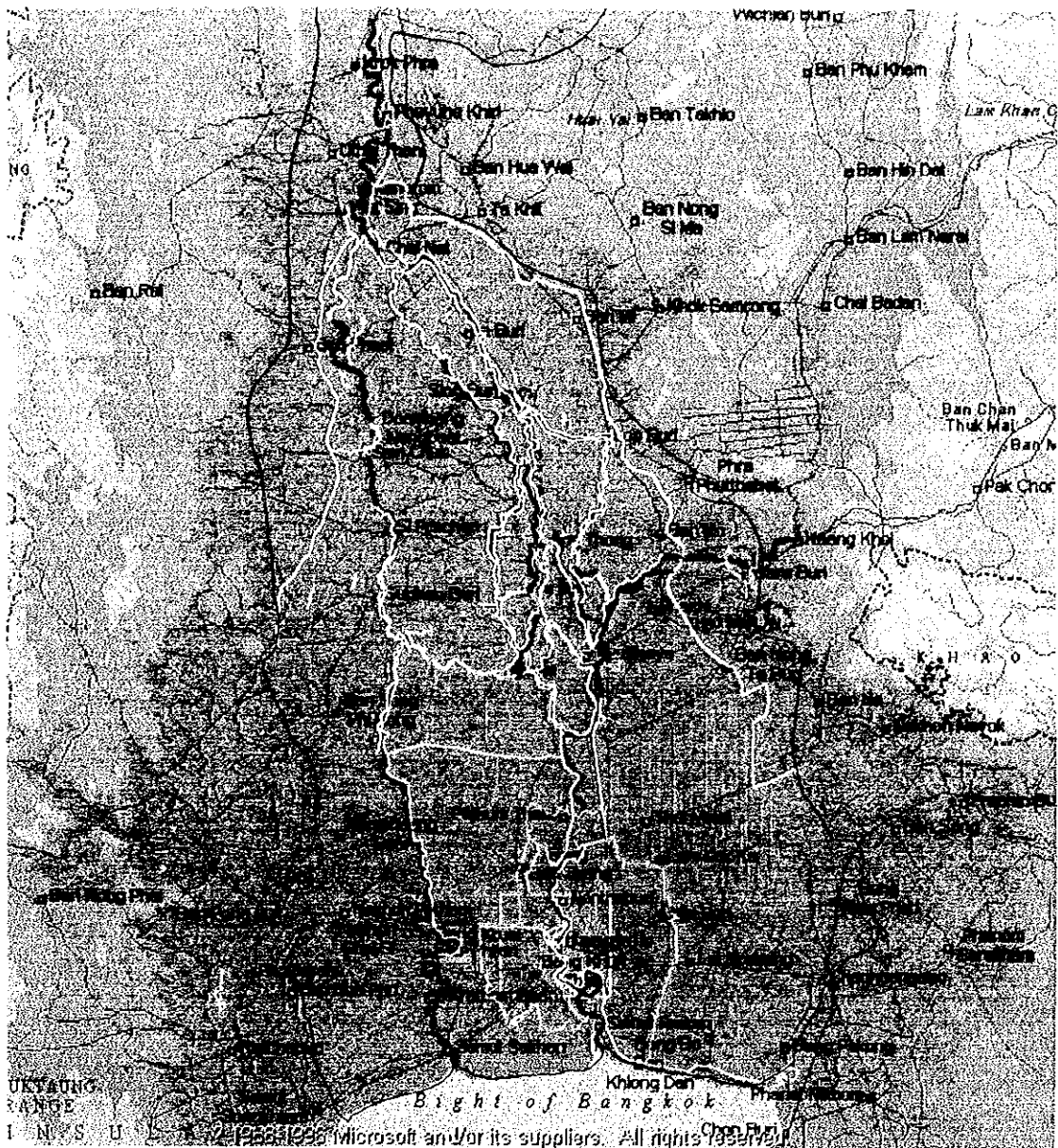
Fig. 5.2.1 LOCATION OF DIKE BREACHES IN 1995 IN MAHARAT PROJECT AREA








STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAO PHRAYA RIVER BASIN

CTI ENGINEERING CO., LTD AND INA CORPORATION

Fig. 5.2.1
LOCATION OF DIKE BREACHES IN 1995
IN MAHARAT PROJECT AREA



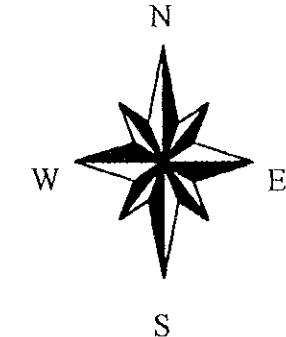
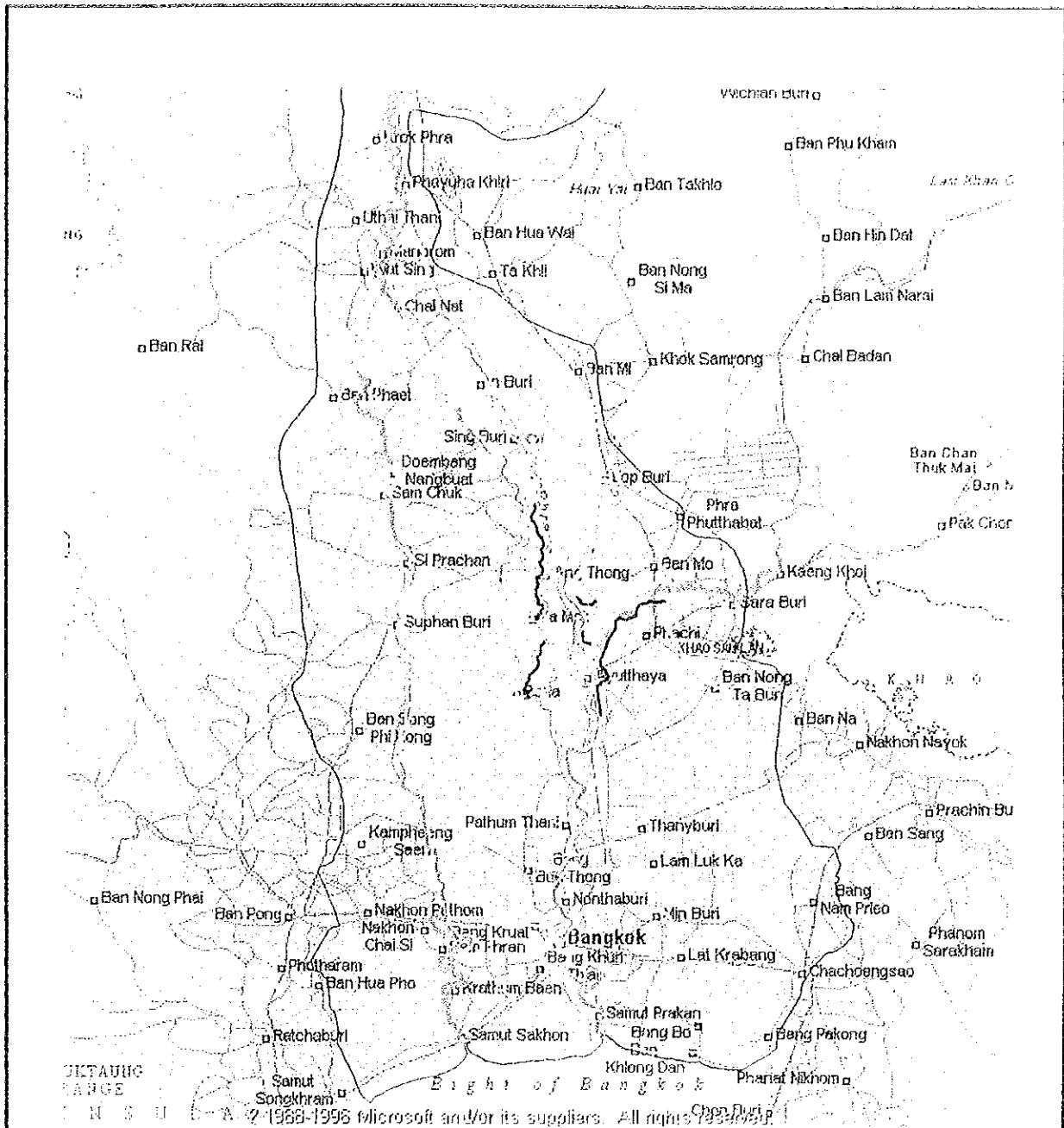
- LEGEND**
-  Flood Area
 -  Improvement after 1995
 -  Urban Dike
 -  Dike
 -  Major rivers

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

CTI ENGINEERING CO LTD., & INA CORPORATION

Fig. S.2.2

LOCATION OF DIKE HEIGHTENING AFTER 1995 FLOOD



- LEGEND**
- Flood Area
 - Improvement after 1995
 - Urban Dike
 - Dike
 - Major rivers

STUDY ON INTEGRATED PLAN FOR FLOOD MITIGATION IN CHAOPHRAYA RIVER BASIN

CTI ENGINEERING CO LTD., & INA CORPORATION

Fig. 5.2.2
 LOCATION OF DIKE HEIGHTENING AFTER 1995 FLOOD